

ACTION MEMORANDUM

**RILEY PASS URANIUM MINES SITE
REMOVAL ACTION**

Within the
NORTH CAVE HILLS LAND UNIT

Custer Gallatin National Forest – Sioux Ranger District
Harding County, South Dakota

April 26, 2016

ACTION MEMORANDUM

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I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the selected non-time critical removal action (proposed action), as authorized by section 104 (42 U.S.C. 9604) of the Comprehensive, Environmental, Response, Compensation, and Liability Act (CERCLA), to address all mined bluffs and other disturbances, such as exploration push pits, within the Riley Pass Uranium Mines Site that are located on the Custer Gallatin National Forest in Harding County, South Dakota. These mined bluffs and other disturbances comprise the Riley Pass Uranium Mines Site (Site). The Site is defined in the Riley Pass Abandoned Uranium Mines Final Engineering Evaluation and Cost Analysis (Final EE/CA) (Pioneer 2006). A map defining the Project Area is provided as Attachment 1.

A release, or a significant threat of a release, has or is occurring at the Site that poses a threat to public health or welfare or the environment, on and/or from lands under the jurisdiction, custody, or control of the United States Department of Agriculture Forest Service (USDA FS), Custer Gallatin National Forest (National Forest System Lands or NFS lands). Conditions at the Site present an imminent and substantial endangerment to human health and the environment due to the high concentrations of arsenic, molybdenum, thorium, uranium, and radium-226 (Ra-226) metals and radionuclides found in the soils and sediment from the mining area. The contaminants found at the Site with the greatest impact or potential impact include Ra-226 and uranium.

These conditions meet the criteria for initiating a Removal Action under 40 CFR Section 300.415 (b)(2) of the National Contingency Plan (NCP). Executive Order 12580 and 7 CFR 2.60(a)(39) delegates CERCLA Removal Action authority to the USDA FS, when the source of the release or potential release of hazardous substances is on or from National Forest System lands. The scope of this proposed action is identify response actions that will control and contain the release of and exposures to specific contaminants that are impacting human health and the environment at the Site. These response actions will address all contaminant sources or the impacts from these sources in the encompassing Site. Additional actions may be necessary to address other sources and impacts at the Site.

The response actions set forth in this Action Memorandum are consistent with the Final EE/CA that was prepared for the Forest Service by its consultant Pioneer Technical Services (Pioneer). The Final EE/CA developed various alternatives that address the impacts associated with hazardous substances present at the Site (Pioneer 2006). Additional waste characterization (Tetra Tech 2013b, Tetra Tech 2015c) and verification sampling (Tetra Tech 2012a, Tetra Tech 2013a, Tetra Tech 2015a, Tetra Tech 2015b) and design work has been completed by Tetra Tech Inc. for the Forest Service. The Final Waste Characterization Evaluation Report, November 18, 2015 (Tetra Tech 2015d) and Final Verification Sampling Plan, November 18, 2015 (Tetra Tech 2015e) details this work. This additional information has further characterized the waste at the Site and the need for additional waste characterization. This information is being used in the final design for the response actions at the Site. The discussion in the balance of this Action Memorandum substantiates the need for response actions, identifies the proposed action, provides

specific risk reduction criteria under which the proposed action will be conducted, provides a determination that these criteria are protective of human health and the environment, and explains the rationale for the USDA FS selection of the proposed action.

The proposed action will be executed by following the non-time-critical removal action process as defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA; 42 USC 9604) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP; 40 CFR Part 300). Response actions as explained in the U.S. Environmental Protection Agency's (EPA) *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* -- are implemented to respond to "the cleanup or removal of released hazardous substances from the environment ... as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment..." (EPA, 1993).

II: SITE CONDITIONS AND BACKGROUND

A. Site Description

Riley Pass is part of the North Cave Hills unit within the Sioux Ranger District, Custer Gallatin National Forest, Harding County, South Dakota. The Site is located 25 miles north of Buffalo, South Dakota. The nearest town is Ludlow, South Dakota, which lies 5 miles to the east. A small fraction of the Site is situated on private land (USFS 2007). The Riley Pass Site was originally identified as 12 study areas referred to as Bluff A through Bluff L. In 2013, Bluff C, Bluff D, and Bluff E were categorized as "Bluff CDE." The Site consists of 10 study areas referred to as Bluff A, Bluff B, Bluff CDE, Bluff F, Bluff G, Bluff H, Bluff I, Bluff J, Bluff K, and Bluff L.

The North Cave Hills unit serves as the headwaters of the South and North Forks of the Grand River, which eventually flows into the Missouri River at Mobridge, South Dakota over 200 miles away. There are four notable drainages or creeks within the vicinity of the Site, including Pete's Creek directly to the east of Bluff B, Campbell Creek to the southwest of the Site, Schleicht Draw south of Bluff B.

The Site includes steep-sided and flat-topped buttes that are rimmed with sandstone cliffs. From a geomorphic perspective, this area contains evidence of geologically rapid retreat (Stone et al. 2009). The climate in the region is intercontinental semi-arid that is characterized by warm dry summers and cool dry winters with an average precipitation of 15 inches per year. Snowfall does not typically contribute to the total precipitation amount. The uranium mines located in this region were lignite mines located on tops of the buttes. Mining features include bluffs, overburden piles (spoils), and hazardous erosional openings and highwalls. Samples of spoils materials have been characterized as sandy clay and clayey sand. Within the North Cave Hills, documented mine sites, spoils, and exploration activities cover almost 1,000 acres. However, the estimated disturbed areas within the Site include 316 acres of highwalls, pit floors, and spoils piles. Spoils were pushed over the edges of the buttes onto the steep slopes below the rimrocks during mining. Additional spoils have been deposited on the slopes and areas below the bluffs.

Under the General Mining Laws, per the Atomic Energy Act of 1946 and Public Law 357, unrestricted strip mining took place within the North Cave Hills during the 1950s and 1960s. Uranium exploration began in the North Cave Hills in 1954 when the Atomic Energy Commission recorded high radiation anomalies over the North Cave Hills (Curtiss 1955; Stone et al. 2009). The first claims were staked in August 15, 1954; extensive mining started in the early 1960s in an effort to supply contracts for uranium, but all mining ceased in 1964. The strip mining involved removal of uranium-bearing lignite coal beds, with no requirements for environmental restoration or for establishing post-mining responsibility (Pioneer 2006). The nature of mining that took place resulted in acute environmental degradation and has eroded the soils and affected drainages and water supplies. Numerous investigations conducted at the Site have shown impacts consisting of heavy metal and radionuclide releases associated with the mining.

The following sections describe an overview, characterization and reclamation status for each of the study areas at the Site. Future work at each bluff is discussed in Section V.A.1.

Bluff A

The Bluff A study area, shown in Attachment 1, encompasses 6.2 acres. Using all available data, the Bluff A study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 4.1 acres. Bluff A is located approximately 0.25 miles north of Bluff B in Township 22 North, Range 5 East, Sections 22 and 23. The EE/CA (Pioneer 2006) stated that Bluff A encompasses 3 acres of disturbed area, of which 1 acre is unvegetated spoils. A major characteristic of Bluff A is the peninsula-like rimrock oriented in an east-west direction (MSE 2009). Spoils materials are located on the south side of Bluff A and drain toward a dry draw that adjoins a large spoils pile area associated with Bluff B. The spoils are extremely steep (approximately 1.5 horizontal [H]: 1 vertical [V]) with very little vegetation. The remaining areas of Bluff A are also disturbed and exhibit poor vegetative growth.

Bluff A was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Pioneer's 1999/2000 sampling investigation indicated that molybdenum, uranium, and Ra-226 soil concentrations exceeded background concentrations greater than three times. The EE/CA (Pioneer 2006) specified that before the response actions be designed, the study area should be re-sampled and the results should be reevaluated to confirm soil amendments and nutrients required to establish vegetation. Bluff A was subsequently characterized by X-ray fluorescence (XRF) field and gamma survey in 2008 by MSE (MSE 2009). A total of 37 surface XRF readings were taken to characterize the distribution of arsenic, along with five surface confirmatory soil samples. A total of 12 XRF arsenic readings were above 142 milligrams/kilograms (mg/kg). A gamma survey of Bluff A indicated Ra-226 concentrations above 30 picocuries per gram (pCi/g) in the northern and southeastern sections of the study area, where a majority of the high arsenic results were obtained. However, high levels of arsenic were also detected in surface and subsurface samples collected from an area where Ra-226 was estimated to be below 30 pCi/g (MSE 2009). Arsenic concentrations ranged from 38 mg/kg to 345 mg/kg. The EE/CA (Pioneer 2006) stated

the estimated spoils volume is 25,250 cubic yards (yd³). Organic matter content on Bluff A was 8.4 percent (Pioneer 2006). MSE (2009) reported waste volumes based on removal action cleanup standards from the 2010 Action Memorandum (USFS 2010). MSE (2009) reported a mine waste volume of 1,961 yd³. These volumes will need to be recalculated based on the new waste categorization criteria presented in this Action Memorandum.

No removal actions have been performed to date at Bluff A.

Bluff B

The Bluff B study area, shown in Attachment 1, encompasses approximately 153 acres of spoils piles (overburden), highwalls, and open pits. Using all available data, the Bluff B study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 138 acres. Bluff B is located in parts of Township 22 North, Range 5 East, Sections 22,23,26 and 27. A significant historical pioneer wagon route during the 1890s is located within approximately 500 feet of the study area. Bluff B is the largest study area at Riley Pass and the waste materials (spoils and overburden) have been a major source of sedimentation to Pete's Creek to the east of Bluff B and Schleichart Draw to the southeast. A majority of the bluff is either barren or sparsely vegetated and shows signs of severe erosion by wind and surface water. Sediment from the east half of the site is currently being carried approximately 0.75 mile and deposited on the main access road to Riley Pass and the adjoining private property. There are no sediment ponds to capture this runoff from Bluff B.

Sedimentation ponds have been installed and maintained by the USFS in Upper Pete's Creek and Schleichart Draw. However, as a result of the amount of sediment eroding from the site, frequent maintenance of the sedimentation ponds is required. Because of the predominant soil type present — sandy clay and silty clay — soil piping and tunneling with occasional sink holes are present. Piping and large gullies are most prevalent in areas where the overburden was placed along or below the rimrocks. Some of the pipes that have formed are 10 feet to 15 feet in diameter, and gullies up to 25 feet in depth have formed in places. The mined pit floors are generally at or near bedrock. Some spoils have been placed along the edges that erode to the land below Bluff B. Small shallow ponds have formed in some of the areas, creating small retention basins, which during snowmelt and small storm events assist in controlling some of the surface water erosion. Water from these ponds most likely evaporates or seeps through the bedrock during the summer.

Bluff B was first studied by Knight Piesold in 1990 and 1991 to evaluate existing conditions, develop plausible response action alternatives, and provide a cost estimate for each alternative (Pioneer 2006). Knight Piesold's 1990/1991 studies consisted of water quality analysis and collection of radiological measurements. Additional characterization was performed by Pioneer in 1999 and 2000 (USFS 2002). Concentrations greater than three times background of Ra-226 and uranium-235 (U-235) were documented from sample RP-SS-B1 during Pioneer's 1999/2000 sampling investigation. Low organic matter content was observed during that investigation (1.2

percent). Information from the Pioneer study was used to identify contaminants of potential concern (COPCs) by comparing with background concentrations to be used in the risk assessment (Portage 2006). A supplemental sampling investigation was performed by Portage in 2004. Information from the 2004 investigation was used in development of the risk assessment and EE/CA (Pioneer 2006; Portage 2006). The Final EE/CA recommended that Bluff B should be re-sampled before a detailed response action design be completed. Bluff B was characterized in 2007 as part of the Phase 1 work executed by AECOM on behalf of Tronox, the results are summarized in AECOM (2008a). The estimated total arsenic concentrations were derived from robust correlations between total and plant available arsenic concentrations, none of these estimated total arsenic concentrations in soil exceeded 142 mg/kg AECOM (2008a). Multiple areas exceeding Ra-226 soil cleanup levels were identified based on results of a gamma radiation survey AECOM (2008a). No XRF field surveys were performed during the 2007 investigation by AECOM.

The Action Memorandum (USFS 2007) presented removal action cleanup standards for Bluff B and all other Tronox bluffs in 2007. Numerous investigations had been performed at the study area; however, no study has characterized the spatial extent of contamination in extreme detail until 2012. In 2012, a comprehensive characterization (Tetra Tech 2013b) was conducted on behalf of the USFS. A total of 804 XRF measurements and 34 soil confirmation samples along with 67,000 gamma exposure rate measurements were collected at Bluff B. The Ra-226 activity ranged from 0.56 pCi/g to 1,846 pCi/g with an average of 11.8 pCi/g. Arsenic concentrations ranged from 3 mg/kg to 2,838 mg/kg. Approximately 14 percent (22 acres) of Bluff B was identified as exceeding one of the COPCs and requiring removal action as described in Tetra Tech (2013b). The estimated spoils volume at Bluff B is 1,140,000 yd³ (Pioneer 2006). Tetra Tech (2013b) provided an estimate of 1,908,512 yd³ total waste material volume at Bluff B.

Numerous erosion prevention actions have been conducted at Bluff B by the USDA FS and Tronox; however, no specific removal action for the reclamation of the study area has been conducted to date.

Bluffs CDE

The Bluff CDE study area, shown in Attachment 1, encompasses 48.1 acres. Using all available data, the Bluff CDE study area boundary was revised from the historical boundaries provided to Tetra Tech. Bluff CDE was originally delineated by the USFS as three separate study areas (Bluff C, Bluff D, and Bluff E). The original boundary extents of Bluff C, Bluff D, and Bluff E were 11.3 acres, 5.02 acres, and 0.935 acre, as presented in Tetra Tech (2013b). The EE/CA (Pioneer 2006) speculated that minimal response action work was deemed necessary at these original areas given the existing stable vegetation. However, during the 2012 investigation (Tetra Tech 2013b) it was discovered that these study areas are all geographically interconnected and a change order was approved to fully delineate the extent of contamination outside of the previously delineated boundaries of the study area. Based on the results of that investigation, these three individual study areas were combined into one larger area

referred to as "Bluff CDE.". Bluff CDE is located approximately 0.8 miles southeast of Bluff B in Township 22 North, Range 5 East, Section 26.

The EE/CA (Pioneer 2006) specified that mining-related disturbance was relatively small at Bluff C, Bluff D, and Bluff E. However, a detailed waste characterization investigation had not been performed at these areas when that statement was made. Additionally, the risk assessment (Portage 2006) stated that Bluff H generally represented the highest levels of contamination from all of the study areas. These statements were made based on limited data. Prior to 2012, Bluff C, Bluff D, and Bluff E were characterized during the Pioneer 1999 and 2000 field sampling investigation (USFS 2002).

Tetra Tech performed a comprehensive investigation at Bluff CDE in 2012 and concluded that the waste was more prominent than been previously expected (Tetra Tech 2013b). A total of 293 XRF measurements and 19 soil confirmation samples along with 22,000 gamma exposure rate measurements were collected at Bluff CDE. The Ra-226 activity ranged from 1.5 pCi/g to 3,699 pCi/g with an average of 86.8 pCi/g. Arsenic concentrations ranged from 5.2 mg/kg to 2,953 mg/kg with an average of 230 mg/kg. Bluff CDE also had the largest removal area of Category II mine waste (0.99 acre) and Category III mine waste (27.8 acres) as stated in Tetra Tech (2013b) of all study areas.

No removal actions have been performed to date at Bluff CDE.

Bluff F

The Bluff F study area, shown in Attachment 1, encompasses 7.5 acres and has established vegetation of the spoils piles and berms. Some areas of exposed bedrock are located within the study area. There are no signs of erosion from the berms or spoils piles, and vegetation cover at Bluff F is approximately 90 percent to 95 percent (Pioneer 2006). Using all available data, the Bluff F study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 2.1 acres. Bluff F is located 1.2 miles southeast of Bluff B in Township 22 North, Range 5 East, Section 35. Aerial photos of Bluff F are provided in Appendix E.

Bluff F was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Concentrations greater than three times background of molybdenum, Ra-226, and U-235 were documented for Bluff F during Pioneer's 1999/2000 field sampling investigation. Bluff F was characterized by MSE in 2008 (MSE 2009).

In May 2015, Tetra Tech reviewed all available data at Bluff F and identified areas where additional data gaps were still present, including an area with Ra-226 concentrations in soil exceeding the risk-based cleanup criteria presented in this Action Memorandum with no arsenic data available for that same location. The USDA FS requested Tetra Tech perform XRF field surveys and gamma radiation surveys at Bluff F under Modification #1 for contract AG-02-02NV-D-15-0004 dated June 9, 2015. The additional characterization surveys were performed by Tetra Tech field engineers in

July 2015 and the results of this investigation are presented in Tetra Tech (2015a). The data collected in July 2015 was validated and incorporated into the final project geodatabase.

The USDA FS reclaimed two separate areas at Bluff F in 2012 under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011. A verification survey report outlining the removal action efforts during 2012 is presented in Tetra Tech (2013a). Removal action was successful at the western portion of Bluff F; however, cleanup attainment was not achieved at the northeastern portion of Bluff F (Tetra Tech 2013a), and further areas were identified during the verification surveys that required removal at Bluff F. In 2014, under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-14-0010, final removal action and attainment of cleanup standards was achieved at Bluff F, as summarized in Tetra Tech (2015d); however, additional areas designated as Bluff F will require additional reclamation and removal action work.

Bluff G

The Bluff G study area, shown in Attachment 1, encompasses 7.1 acres, of which approximately 2 acres consist of exposed bedrock. Using all available data, the Bluff G study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 3.6 acres. Bluff G is located approximately 1.5 miles southeast of Bluff B in Township 22 North, Range 5 East, Section 36. There are several bare and eroding steep (1.5H: 1V) slopes, where the materials have been pushed off the rimrock.

Bluff G was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Pioneer's 1999/2000 sampling results indicated one acutely contaminated area (RP-SS-G2 [lignite sample]) that has been left on top of the bluff. The greater portion of the top of the bluff has been excavated down to bedrock with very little vegetation present (Pioneer 2006). Vegetation is present on some of the less steep slopes. There are several berms and spoils piles along the north and east side of the bluff. Surface erosion is localized to two areas on the berms and spoils piles on the north side of the bluff. Access to Bluff G is gained by traveling over Bluff I; the EE/CA (Pioneer 2006) recommended that reclamation of Bluff G should be completed before any response actions at Bluff I. Concentrations greater than three times background of arsenic, molybdenum, uranium, and Ra-226 were documented for Sample RP-SS-G 1 during Pioneer's 1999/2000 sampling investigation (USFS 2002).

Bluff G was more comprehensively studied by Tetra Tech in 2012 (Tetra Tech 2013b). A total of 54 XRF measurements and 9,000 gamma exposure rate measurements were collected at Bluff G. The Ra-226 activity ranged from 1.35 pCi/g to 1,493 pCi/g with an average of 42.4 pCi/g. Arsenic concentrations ranged from 14.8 mg/kg to 1,483 mg/kg with an average of 256 mg/kg. Arsenic or Ra-226 soil concentrations in approximately 5 acres of Bluff G are above the risk-based cleanup criteria (Tetra Tech 2013b). Per the recommendations in Tetra Tech (2013b), a supplemental field investigation was performed east of Bluff G. The results of the supplemental sampling investigation are

presented in a technical memorandum to the USFS (Tetra Tech 2015c).

In May 2015, Tetra Tech reviewed all available data at Bluff G and identified areas where additional data gaps were still present. The USFS requested Tetra Tech perform XRF field surveys and gamma radiation surveys at Bluff G under Modification #1 for contract AG-02-02NV-D-15-0004 dated June 9, 2015. The additional characterization surveys were performed by Tetra Tech field engineers in July 2015 and the data transmittal report is presented in Tetra Tech (2015b). The data collected in July 2015 was validated and incorporated into the final project geodatabase. Tetra Tech (2013b) provided an estimate of 72,395 yd³ total waste material volume at Bluff G.

The USDA FS reclaimed five separate areas at Bluff G under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-14-0010. The verification arsenic XRF/soil sampling performed at the Bluff G reclaimed areas indicated that all the levels collected within these areas were below 142 mg/kg of arsenic. Further field verification sampling indicates that there are areas within the reclaimed areas that exceed arsenic soil concentrations of 142 mg/kg. Attainment of the Ra-226 soil cleanup objectives at the reclaimed areas at Bluff G were previously determined to be successful (Tetra Tech 2015d). Further removal action work at Bluff G will be conducted to reduce the arsenic and Ra-226 concentrations below the risk-based soil cleanup levels presented in this Action Memorandum.

Bluff H

The Bluff H study area, shown in Attachment 1, encompasses approximately 33.7 acres. Using all available data, the Bluff H study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 29.8 acres. Bluff H is located approximately 1.9 miles southeast of Bluff B in Township 22 North, Range 5 East, Sections 25 and 36. The Bluff H study area consists of several spoils piles that have been placed along and over the rimrock edges; these slopes are generally very steep (1.5H : 1 V) and show signs of severe water erosion, especially on the northwest and northeast spoils piles (Pioneer 2006). Vegetation growth on the side slopes is limited. There is a pit area with unstable highwalls on the southwestern portion of the site. A portion of the spoils piles on the north and northeast side of the bluff is currently located on private property. A spoils pile of approximately 1.1 acres is located on the northwest corner of the bluff (Pioneer 2006), and the slope is extremely steep (1.5H : 1V) and barren of vegetation. One large erosion gully is located on the south portion of the spoils pile. The water and sediment from this gully flow into an intermittent dry draw and drainage. However, some of the sediments are being deposited on private property adjacent to Bluff H. The spoils pile located on the northeast end of the study area is moderately vegetated. Erosion gullies and rills are transporting sediment onto private property and into an intermittently dry draw and drainage. Approximately one-third of this spoils pile is currently situated on private property. A large spoils pile located on the west side of the bluff encompasses 3 acres (Pioneer 2006). The spoils are sparsely vegetated, with numerous erosion gullies and rills. One large erosion gully (approximately 12 feet deep) is located on the south end of the spoils pile and drains into an intermittent dry draw and drainage. A spoils pile

containing encompassing 4 acres is located on the southern end of the bluff. This spoils pile is moderately vegetated with limited signs of surface erosion.

Bluff H was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Pioneer's 1999/2000 sampling results indicated concentrations greater than three times background of arsenic, molybdenum, uranium, and Ra-226 in Sample RP-SS-H1. Concentrations were less than three times background for all metals analyzed in Sample RP-SS-H2. Pioneer personnel identified one hot spot (RP-SS-H3 [lignite sample at the base of the northwest high wall on Bluff H] (Pioneer 2006). The EE/CA (Pioneer 2006) recommended that it should be resampled, and the results reevaluated to confirm amendments and nutrients required to establish vegetation before the detailed response action design for Bluff H was completed.

Bluff H was more comprehensively studied by Tetra Tech in 2012 (Tetra Tech 2013b). A total of 199 in situ XRF measurements and 18,000 gamma exposure rate measurements were collected at Bluff H. Arsenic concentrations ranged from 9.1 mg/kg to 1,431 mg/kg with an average of 136 mg/kg. The Ra-226 soil concentrations ranged from 1.11 pCi/g to 1,367 pCi/g with an average of 12.1 pCi/g. Arsenic or Ra-226 soil concentrations in approximately 10 acres were above risk-based cleanup criteria. Per the recommendations in Tetra Tech (2013b), a supplemental field investigation was performed west of Bluff H. The results of the supplemental sampling investigation were presented in a technical memorandum to the USFS (Tetra Tech 2015c). Tetra Tech (2013b) provided an estimate of 699,513 yd³ total waste material volume at Bluff H.

No removal actions have been performed to date at Bluff H.

Bluff I

The Bluff I study area, shown in Attachment 1, encompasses 30.8 acres. Using all available data, the Bluff I study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 22.2 acres. Bluff I is located approximately 0.25 miles south of Bluff F along an unmarked USFS road in Township 22 N, Range 5 East, Sections 35 and 36. The majority of the waste materials are unvegetated and eroding into an intermittently dry draw north of the bluff (Pioneer 2006). Vegetation has established along the southern highwalls and moderately within the pit areas. The spoils piles and waste materials have been placed on and over the northern edge of the rimrock and are considered the primary source of sedimentation of the draw north of the bluff.

Bluff I was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Two soil samples (RP-SS-I1 and RP-SS-I2) were collected from Bluff I. A more comprehensive characterization study was performed by MSE and Tetra Tech in 2008, and the results are presented in MSE (2009). The 2008 investigation consisted of in situ XRF field surveys, gamma radiation surveys, and soil sampling at Bluff I. The XRF field survey results indicated a number of the surface soil XRF readings resulted in arsenic concentrations above 142 ppm (MSE 2009). The gamma

survey results revealed that Ra-226 soil concentrations greater than 30 pCi/g occur intermittently throughout the Bluff I study area (MSE 2009).

In May 2015, Tetra Tech reviewed all available data at Bluff I and identified areas where additional data gaps were still present. The USFS requested Tetra Tech perform XRF field surveys and gamma radiation surveys at Bluff I under Modification #1 for contract AG-02-02NV-D-15-0004 dated June 9, 2015. The additional characterization surveys were performed by Tetra Tech field engineers in July 2015 and the data transmittal report is presented in Tetra Tech (2015a). The data collected in July 2015 was validated and incorporated into the final project geodatabase.

Numerous reclamation activities have been conducted by the USDA FS at Bluff I, to varying degrees of success. Successful removal action at the eastern section of Bluff I was conducted in 2012 under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011, and the verification results are presented in Tetra Tech (2012a and 2012b). Additional removal action activities were conducted in 2013 and 2015 at the western and southern portions of Bluff I under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011, and the results are presented in Tetra Tech (2013a) and Tetra Tech (2015a). The degree of success varies within the previously reclaimed areas as discussed in Tetra Tech (2013a and 2015a). Additional removal activities will be conducted to reduce the arsenic and Ra-226 concentrations below the risk-based soil cleanup criteria presented in this Action Memorandum.

Bluff J

The Bluff J study area, shown in Attachment 1, encompasses 8.75 acres consisting of highwalls, spoils piles, berms, and road cuts into the side of the bluff (USFS 2006). Using all available data, the Bluff J study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 4.2 acres. Bluff J is located in Township 22 North, Range 5 East, Section 20.

Bluff J was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). Concentrations in soil greater than three times background for Ra-226 were documented (USFS 2002). A more comprehensive characterization study involving an XRF field survey and gamma survey was performed at Bluff J by MSE and Tetra Tech in 2008, and the results are presented in MSE (2009).

Reclamation of Bluff J was performed in 2010. Using the Ra-226 cutoff limit established at the time (90 μ R/hr), a few relatively small areas were detected on Bluff J, which were in excess of the target concentration of 30 pCi/g Ra-226. In 2010, the USFS capped the radiation hot spots on the periphery of the Bluff J boundary with an average of 18 inches of cover soil. An elevated area of gamma and radium in the middle of a potential borrow area within Bluff J was not covered, as this area appeared undisturbed and was not likely to be used for soil borrow in the future. A total of 39 verification samples were collected at Bluff J as part of the 2010 verification survey. All samples were below the arsenic cleanup criteria. Cleanup attainment was achieved at Bluff J after the 2010 reclamation, as summarized in MSE (2010c). The available data

shows a remaining hot spot for Ra-226, Bluff J has been reclaimed based on the previously established verification sampling plan (MSE 2010b) and 2010 Action Memorandum (USFS 2010) cleanup criteria. Additional characterization work will be conducted at Bluff J.

Bluff K

The Bluff K study area, shown in Attachment 1, encompasses 10.6 acres consisting of two spoils piles and berms within an open grass meadow in the middle of a bluff. There are no highwalls associated with this bluff. Using all available data, the Bluff K study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 6.1 acres. Bluff K is located in Township 22 North, Range 5 East, Section 21. There are no signs of erosion from the berms or spoils piles; vegetation at the site consists of approximately 90 percent vegetative cover (Pioneer 2006).

Bluff K was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). One acutely contaminated area was observed during this sampling investigation. It is located at the end of a small dozer cut within the berm materials and is located on the southeastern portion of the site. A more comprehensive characterization study involving an XRF field survey and gamma survey was performed at Bluff K by MSE and Tetra Tech in 2008, and the results are presented in MSE (2009). During the 2008 investigation, soil samples were collected at Bluff K. One surface sample contained arsenic at 788 mg/kg, and one subsurface sample collected at 1.5 feet below ground surface had an arsenic concentration of 443 mg/kg. Another subsurface sample, which was collected from inside an animal burrow in a large mound, contained an arsenic concentration of 167 mg/kg (MSE 2009).

The USDA FS performed reclamation at Bluff K in 2010. Two small, slightly elevated areas bordering the south edge of the borrow area contained gamma measurements that exceeded 90 μ R/hr. However, as mentioned above, these areas did not exceed the cleanup goal of 30 pCi/g; therefore, no cover soil was added to these areas. An XRF field survey was performed by MSE in 2010 to verify attainment of cleanups standards. The results of this verification survey showed that four point measurements of arsenic exceeded the cutoff value of 142 mg/kg; however, in general the cover soils appear to be below the cleanup goal established for arsenic at the site. Consolidated mine waste and spoils materials on Bluff K have been sufficiently covered with clean borrow soil to reduce arsenic concentrations at the surface to less than 142 mg/kg (MSE 2010c). Cleanup attainment was determined to be successful based on the criteria established at the time of verification survey was performed at Bluff K as summarized in (MSE 2010c). Additional characterization work will be conducted at Bluff K.

Bluff L

The Bluff L study area, shown in Attachment 1, encompasses 10.0 acres consisting of several small spoils piles, and old roads throughout the study area. Bluff L is located in Township 22 North, Range 5 East, Section 29. Using all available data, the Bluff L study area boundary was revised from the historical boundary provided to Tetra Tech which previously encompassed 8.2 acres. One larger spoils pile, approximately 44,100 yd³, is located on the north end of the site in a dry draw. These volumes will need to be recalculated based on the new waste categorization criteria presented in this report. Several small erosion rills and gullies have formed on the face of this spoils pile. Vegetation at the site consists of approximately 85 percent to 90 percent vegetative cover in flatter areas and approximately 65 percent to 70 percent vegetative cover on the steeper faces of the spoils pile (Pioneer 2006). There is an exposed lignite coal seam on the eastern side of the large spoils pile.

Bluff L was first studied by Pioneer in a 1999 and 2000 field sampling investigation (USFS 2002). No metal concentrations at the site were documented to be greater than three times the background concentrations. A more comprehensive characterization study involving an in situ XRF field survey and gam survey was performed at Bluff L by MSE and Tetra Tech in 2008, and the results are presented in MSE (2009). Four XRF arsenic measurements exceeded the cleanup criterion of 142 mg/kg.

No removal activities have been performed to date at Bluff L.

1. Removal Site Evaluation

In 1964, the USDA FS noted that overburden from one of the claims mined by Kermac had slipped down the hill through the United States Forest Service (USFS) boundary fence causing considerable disturbance on an adjacent property owner's land and destroying over 320 feet of fence. In 1991, after several other incidents at the Riley Pass Uranium Mining Site, the Forest Service contracted Denver Knight Piesold to conduct an Environmental Evaluation at the main disturbed area (later identified as Bluff "B") within the Site. After 1991, other time-critical actions (described later in this document) were taken at the Site. The potential for similar releases still exist.

In 1999 the USDA FS contracted with Pioneer Technical Services (Pioneer) to complete a Site Investigation. That investigation resulted in a number of water, soil, and sediment samples being collected from the Site and the result of that sampling effort being published in the final Site Investigation (SI) Report that was issued in 2002. Following the issuance of the SI, Pioneer Technical, still under contract with the Forest Service, utilized the result from the SI to develop a Draft Final Engineering Evaluation and Cost Analysis (EE/CA). Additional sampling was done by Portage Environmental (also under contract to the Forest Service) in 2004 in order to develop a comprehensive Human Health and Ecological Risk Assessment that was included into the Draft Final EE/CA, which was completed by Pioneer Technical in 2005. After receipt of public comments on the Draft Final EE/CA, a Final EE/CA (including a

revised Final Risk Assessment) was issued by the USDA FS in October of 2006 (Pioneer 2006).

The Final Waste Characterization Evaluation Report for Riley Pass Uranium Mines Site (North Cave Hills), Harding County, South Dakota (Final Waste Report) dated November 18, 2015 (Tetra Tech 2015d) summarized all available characterization data from all previous studies at the Site. The known contaminants of concern include arsenic, molybdenum, uranium, radium and thorium.

2. Physical Location

The Riley Pass Uranium Mines Site is located in the North Cave Hills area of Harding County, South Dakota. The Site is approximately 25 miles north of Buffalo, South Dakota, which is the county seat, and 100 miles north of Belle Fourche, South Dakota. Ludlow, South Dakota, is the nearest town to the Site and is located approximately five miles due east. The Sioux District Office of the Custer Gallatin National Forest of the USDA FS administers the Site. The mined areas that are associated with the Site cover approximately 316 acres of highwalls, pit floor, and spoils in Sections 20, 21, 22, 23, 25, 26, 27, 29, 35, and 36 of Township 22 North, Range 5 East of the Black Hills Meridian and are broken into 12 bluffs. These bluffs are shown on the enclosed map (Attachment 1). The Site is bordered by NFS, private, and U.S. Department of Interior/Bureau of Land Management (BLM) land.

The North Cave Hills area serves as the headwaters of the South and North Forks of the Grand River which flows into the Missouri River at Mobridge, South Dakota, approximately 200 miles away.

There are currently several ranches within one to five miles of the Site. Primary land uses in the area include grazing, hunting, hiking, ATV/motorcycle use, camping, and Native American spiritual use.

3. Site Characteristics

The Site is located at an elevation of approximately 3,200 feet above mean sea level. The USFS records from 1931 through 1973 report average annual precipitation at Ludlow, South Dakota, at 14.8 inches. Approximately 73% or 10.8 inches of this precipitation appears in the form of rain during May through September. Significant precipitation occurs during convective storms, often accompanied by strong winds and occasional flash flooding. June is the wettest month of the year with an average rainfall slightly over three inches.

The North Cave Hills form a diverse and varied landscape compared with the surrounding short and midgrass prairies. The rimrock hills, with their complex slopes and aspects, create unique microclimates and diverse vegetation. Several habitat types have been recognized by the USDA FS in this region. Landscapes include hardwood draws, ponderosa pine woodlands, and several grassland ecosystems.

4. Release or Threatened Release into the Environment of a Hazardous Substance

a. Hazardous Substances

The hazardous substances, as defined in section 101(14) of CERCLA, found at the site include arsenic, molybdenum, uranium, radium, and thorium. Concentrations of hazardous substances in surface water are documented in the Final EE/CA (Pioneer 2006). Concentrations of hazardous substances in solid wastes are documented in the Waste Characterization Evaluation Report (Tetra Tech 2015d).

b. Sampling and Analytical Data

Water: Surface water sampling took place at several locations within the various drainages associated with the Site as well as two other non mined drainages. Indications are that the water quality for the area is naturally degraded due to the mineralization associated with the area. However, it was documented that the historic mining activity and subsequent erosion stemming from that activity is locally impacting the surface water quality from the source of the contaminants to points at or near the Forest Service boundary.

Solid Waste: Removal action cleanup objectives and criteria for solid waste were established for the Site in (USFS 2007, USFS 2010). However, significant data have been collected and analyzed since the removal action determinations and risk assessment were completed. In 2015, the Waste Characterization Evaluation Report (Tetra Tech 2015d) documented the evaluation of all historic waste characterization data collected at the site and established site cleanup criteria. The cutoff levels for the site cleanup criteria are the same cutoff cleanup levels used in 2007 and 2010. These risk based cleanup criteria (Tetra Tech 2015d) will be used for all future characterization data collection, reclamation design, and verification sampling work.

Two separate Action Memorandums (USFS 2007, USFS 2010) summarized removal action cleanup criteria for the Site. The approach for cleanup in the 2007 Action Memorandum involved a complex matrix of two criterion, Criterion 1 contained a breakdown of three categories of waste based on contaminant levels. Criterion 2 specified a set reclamation for certain study areas. Additionally the approach assumed a direct correlation existed between arsenic and Ra-226 concentrations and stated that Ra-226 would be used as a direct clean-up guideline.

The approach for cleanup in the 2010 Action Memorandum specified that Criterion 1 (from the 2007 Action Memorandum) be applied in part. Contrary to the 2007 Action Memorandum, the 2010 Action Memorandum acknowledged that the arsenic and Ra-226 concentrations are not always correlated, therefore, these two constituents should be measured independently for characterization and verification

that cleanup has been attained. This approach is valid and continues to apply to future removal actions at the Site.

This 2016 Action Memorandum supersedes the 2007 and 2010 Action Memorandums (USFS 2007, USFS 2010).

A baseline human health and ecological risk assessment, titled Final Human Health and Ecological Risk Assessment for the Riley Pass Uranium Mines in Harding County, South Dakota, was published by Portage Environmental Inc. (Portage) in May 2006 (Portage 2006). The baseline human health risk assessment was conducted in general accordance with the NCP and other EPA guidance (Pioneer 2006). Portage (2006) assessed human exposures for several different receptors at Bluffs B and H and lignite exposures to the COPCs identified in soils, which included the following:

- Arsenic
- Molybdenum
- Selenium
- Uranium (U) as uranium-238 (U-238), uranium- 234 (U-234), and U-235
- Ra-226
- Thorium-230 (Th-230)

The risk assessment indicated that the COPCs to be carried forward included arsenic, molybdenum, uranium isotopes, and Ra-226 (Portage 2006). The following cleanup goals for waste categorization were subsequently proposed in Tetra Tech (2013b):

- Arsenic: 142 mg/kg
- Molybdenum: 2,775 mg/kg
- U-238: 42.8 pCi/g
- U-234: 44.6 pCi/g
- U-235: 2.03 pCi/g
- Ra-226: 30.0 pCi/g

A comprehensive analysis was performed to determine if uranium (U-234, U-235, and U-238) and molybdenum concentrations in soil exceeding the cleanup standards would be contained in any area once the arsenic and Ra-226 met the cleanup criteria.

The results of this analysis show that using arsenic and Ra-226 as the contaminants for the basis of cleanup decisions at the Site will result in the removal of soils contaminated with uranium and molybdenum above the cleanup levels shown above. Results of this analysis also concluded that using solely arsenic and Ra-226 soil cleanup concentrations as the driving force during all future characterization and cleanup verification efforts will satisfy project objectives. Therefore, a site-wide cleanup standard solely based on arsenic and Ra-226

concentrations in soil will be applied for all future characterization and verification of cleanup attainment at the Riley Pass Site.

c. Mechanism for Past, Present, or Future Release

The sediment and mine waste generated by past mining activity at the Site, to a large extent, are un-vegetated and highly erosive due to the geology of the material. Runoff erodes material into Pete's Creek and Schleichart Draw. Winds could also cause material to be airborne and transported offsite.

d. Events or Features that Could Spread or Accelerate Releases

Large runoff events, particularly during the late summer, present potential conditions for increasing erosion of the material into the surface water drainages and onto the surrounding land surfaces. Water quality in Schleichart Draw has been shown to be impacted by the contaminants. Retention ponds built by the Forest Service in the 1980s, have been filled to capacity and have been cleaned out on at least three occasions. Additional sediment loading and eventual embankment failure of these retention ponds could result in large-scale releases. Schleichart Draw reservoir and the Ducks Unlimited pond also appear to contain large amounts of sediments eroded from the mined areas.

e. Properties that Influence the Rate of Releases

The primary mechanisms of movement of contaminated material include:

- Erosion into surface water courses and onto adjacent land
- Dissolution of contaminants in runoff
- Infiltration of dissolved metals into soil

Because of its chemical and soil characteristics, the contaminated material associated with the historic mining activity does not readily support plant life and continues to be vulnerable to erosion by water and wind. In addition, the contaminated materials are uncontained and the outer slopes are quite steep, contributing to accelerated erosion.

Removal actions are designed to regrade and vegetate the site, reduce overland migration of the contaminated material, and reduce infiltration of water into the contaminated material which would result in the release of the contamination.

Actions directed at reducing infiltration through, and runoff from, the contaminated material should result in surface water quality improvements.

5. National Priority List (NPL) Status

The Site is currently not on the National Priority List.

6. Maps, Pictures, and other Graphic Representations

A location map is provided as Attachment 1.

B. Other Actions to Date

1. Previous Actions

As previously mentioned, numerous actions, investigations and time critical actions have been taken at the Site. The following list includes select waste characterization, site investigation, Final EE/CA, Action Memorandums, and other investigations:

1999 to 2002- The USDA FS retained Pioneer to conduct all steps needed to produce a Site Investigation (USFS 2002) and Final EE/CA.

2004-The USDA FS retained Portage to gather additional samples and information to produce a comprehensive Human Health and Environmental Risk Assessment.

2004-The USDA FS published a Time Critical Action Memorandum for Sediment Ponds

2005-The Draft Final EE/CA was released to the public and a public meeting was held in May 2005 in Buffalo, South Dakota. Three additional public meetings were held on August 24, 25, and 26, 2005 to solicit comments on the Draft Final EE/CA.

2006-The USDA FS issued the Final EE/CA in November 2006 (Pioneer 2006).

2007-The USDA FS published a Non-Time Critical Action Memorandum for Tronox bluffs (USFS 2007).

2009-Additional waste characterization and design work was completed by MSE Millennium Science and Engineering for the Forest Service (MSE 2009). This additional information further characterized waste at the site and was used in the final design for the response actions.

2010-The USDA FS published a Non-Time Critical Action Memorandum for Non-Tronox Bluffs (USFS 2010)

2012-Additional Tronox Bluff waste characterization was completed by Tetra Tech for the USDA FS. This additional information further characterized waste at the Site and was used in the final design for the response actions.

2013- A Tronox Bluff Waste Characterization Report was published by Tetra Tech for USDA FS (Tetra Tech 2013b)

July 2015-Additional waste characterization was completed at Bluffs F, G, H and I by Tetra Tech for USDA FS. This additional information further characterized waste at the site and was used in the final design for the response actions.

October 2015-A public meeting was conducted by the USDA FS that presented the analysis and recommendations of the Draft Waste Characterization Evaluation Report and Draft Verification Sampling Plan to answer questions and receive public comments.

November 2015-A Final Verification Sampling Plan was published by Tetra Tech for USDA FS (Tetra Tech 2015e)

November 2015-A Final Waste Characterization Evaluation Report was published by Tetra Tech for USDA FS (Tetra Tech 2015d).

Table 1 includes removal action construction work completed at the site from 2008 through 2016:

Table 1: 2008 to 2016 Removal Action Construction Work

Contract Name	Contract Activities	Contract Period of Performance	Contractor	Contract Number	Final Cost
FY 15 Riley Pass FSR 3123	Road maintenance (blading, spot surfacing)	11/18/2015 to 6/30/2016	Penn Blade	AG-0355-D-16-0003	\$140,217
FY 15 Riley Pass Welch Fire Trail	Road reconditioning, surfacing and cattleguards	10/15/2015 to 6/15/2016	Belair Builders Inc	AG-0355-C-15-0004	\$753,700* *initial
FY 15 Riley Pass FSR 3123 and 31231	Road maintenance (blading, spot surfacing)	10/15/2015 to 11/30/2015	Penn Blade	AG-0355-D-15-0008	\$338,188
FY14 Riley Pass Cattleguards	Replace existing cattleguards on Tufte Road #3120	9/1/2014 to 11/16/2014	Hafner Construction Inc.	AG-0355-C-14-0016	\$14,412
FY12 Sioux IDIQ Delivery Order	Road maintenance (blading, spot surfacing)	November 2014	Penn Blade	AG-0355-D-14-0011	\$4963
FY13 Riley Pass Non-Tronox Bluffs I1 and F2 & Tronox Bluff G reclamation	Bluff I repository construction work and waste removal and placement into repository. Construct access road to Bluff G	8/14/2013 to 8/19/2014	Belair Builders, Inc.	AG-0355-S-13-0022	\$843,262

Contract Name	Contract Activities	Contract Period of Performance	Contractor	Contract Number	Final Cost
2014 Forest Service gully Stabilization work	Place hay bales, slash, and rock in gullies down-gradient of Bluff B for erosion control	FY 2014	USFS Force Account (Sioux RD crews)	N/A	\$3000
FY 13 Sioux RD IDIQ – North Cave Hills	Repair low water crossing on FSR #3120 below Bluff B. Erosion control berms constructed on Bluff B	10/7/2013 to 12/2013	Penn Blade	Task order #2 for AG-0355-D-13-0021	\$11,150
Micropurchase: Fence Repair	Repair fences at sediment ponds	August 2013	Hafner Construction Inc.	Micro-purchase	\$550
FY 13 Riley Pass Pond 4 Culvert Repair	Repair leaking outlet at Sediment Pond 4	6/6/2013 to 6/13/2013	Hafner Construction Inc.	AG-0355-P-13-0019	\$2850
FY 12 - Riley Pass Non Tronox Bluffs I1, I3, F1 & F2	Remove and consolidated Bluff I waste and spoils into repository	8/20/2012 to 12/22/2012	Belair Builders, Inc.	AG-0355-C-12-0017	\$436,322.49
FY12 Brown's Pond Dam & Schleichert Draw Reservoir Repair	Repair embankments and spillways at Brown's Pond Dam & Schleichert Reservoir	??????	Hafner Construction Inc.	????	\$14,388
FY12 Riley Pass Sediment Pond Fencing Project	Construct fences around sediment ponds	July 2012	Hafner Construction Inc.	AG-03550C01 200005	\$24,302.50
Micro-purchase: FY13 Riley Bluff I Ditch	Construct stormwater ditch at top of repository	12/2012	Hafner Construction Inc.	Micro-purchase	\$1800
Riley Pass-Non-Tronox Bluff I2 & FSR 3130	Consolidate and compact waste at Bluff I-2, FSR #3130 improvements.	7/15/11 to 6/2012.	Belair Builders, Inc.	AG-0355-C-11-0005	\$540,742.96
2010 and 2011 bluffs J and K construction work	Consolidate and cap mine waste and spoils. Road improvements.	7/27/2010 To 6/24/2011	Belair Builders, Inc.	AG-0355-C-10-0008	\$337,502.02
Repair of sediment pond 2 and 3	Repair and replacement of sediment ponds 2 and 3 dams, inlet/outlet pipes and fill and road materials.	10/30/2010 to 11/10/2010.	Belair Builders, Inc.	AG-0355-C-10-0015	\$100,686.75

Contract Name	Contract Activities	Contract Period of Performance	Contractor	Contract Number	Final Cost
FY09 Riley Pass sediment pond cleanout	Maintain and reconstruct Bluff B access roads. Remove sediments from Bluff B sediment ponds 1, 2, 3, 4, and 5. Repair pond 2 inlet structure and pond 3 embankment.	7/30/2009 to 11/19/2009	Baranko Brothers, Inc.	A6-0355-C-09-0012	\$479,851.87
2008 USFS stabilization work	Install water check dams in Bluff B northeast drainage channel.	10/20 to 10/25/2008	USFS force account work (R4 AML crew).	In-house FS work	\$2,384.37
Riley Pass Road Maintenance	Road maintenance of FSR 3120, 3114, 3123, and 3131.	9/2008 to 10/2008	Latigo Construction Inc.	AG-0355-C-08-0034	\$265,845

2. Current Actions

On-site soils removal and stabilization has been selected as the primary CERCLA response action for achieving a reduction in mine-related wastes affecting potential human and ecological receptors. In this approach, soils are permanently covered in place or moved to a disposal area, compacted and covered. Response action technologies and process options were presented in the Final EE/CA (Pioneer 2006). All of the reclamation alternatives evaluated in the Final EE/CA are applicable to the contaminated solid media. No reclamation alternatives for groundwater, surface water, or contaminated stream sediments were analyzed in detail. The rationale that alternatives for water were not developed is because reclaiming the contaminant sources (source control) will likely reduce problems associated with groundwater, surface water, or stream sediments at a significantly reduced cost.

C. State and Local Authorities' Role

1. State, Local, and Tribal Actions to Date

The USDA FS has been cooperating throughout the project with the South Dakota Department of Environmental & Natural Resources, South Dakota Game, Fish & Parks, the South Dakota Division of Forestry, the South Dakota Governor's Office, the Harding County Commissioners, and the Bowman/Slope Soil Conservation District. A list of Applicable, or Relevant and Appropriate Requirements (ARARs) has been developed for the project with significant input provided by the State of South Dakota.

A briefing was given to the Standing Rock Sioux Tribal Council. Notification letters were sent to the Crow, Northern Cheyenne, Standing Rock Sioux, Cheyenne River Sioux,

Crow Creek Sioux, Lower Brule Sioux, Yankton Sioux, Ogalala Dakota Nation, Mandan-Hidatsa-Aikara and Three Affiliated Tribes regarding various public meetings and opportunities to add input into the process. Meetings were held on the site with various Tribal Historic Preservation officials to receive input concerning cultural concerns at the site.

All cooperating agencies and governments have been provided an opportunity to review the various project documents, specifically the Waste Characterization Evaluation Report (Tetra Tech 2015d) and Verification Sampling Plan (Tetra Tech 2015e) completed for the USDA FS in 2015.

2. Potential for Continued State/Local Response

Neither the State nor local authorities have the resources or authority to conduct a removal action at this time. State and local constituents will continue to be involved in site activities and will be kept apprised of activities conducted as part of this removal action.

III. THREATS TO PUBLIC HEALTH OR WELFARE AND THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES.

The Final EE/CA (Pioneer 2006) indicates there is a threat to public health or welfare, or to the environment as set forth in the National Contingency Plan (NCP) at 40 CFR 300.415(b)(2). Briefly, this threat is the risk associated with exposure to metals and radionuclides in areas impacted by mining and risk of present and future metals and radionuclide contamination of the surrounding lands and surface waters in the Schleicht Draw and Pete's Creek drainages.

Due to the concentrations of contaminants in the mine waste sources, conditions at these sources meet the criteria for initiating a Response Action under 40 CFR 300.415(b)(2) of the NCP. The following factors from 40 CFR 300.415(b)(2) of the NCP form the basis for USDA FS determination of the threat present and the appropriate action to be taken:

- (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
- (ii) Actual or potential contamination of sensitive ecosystems;
- (iii) High levels of hazardous substances, pollutants, or contaminants in soils largely at or near the surface that may migrate;
- (iv) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

A. Threats to Public Health or Welfare

A risk assessment conducted for the USDA FS by Portage (Portage, 2006) identified human-health and ecological risks posed by current conditions at the site that exceed minimum U.S. EPA-defined risk levels that are protective of human health and the environment [i.e., an excess lifetime cancer risk higher than 1×10^{-4} (1 in 10,000)]. The risk assessment determined that the risk levels for maximally exposed individuals could potentially be as high as 3×10^{-3} . Potential human-health exposure pathways identified include ingestion of contaminated soils, surface water contaminated by contact with surface soils, consumption of beef by local ranchers, consumption of game meat by hunters, inhalation of airborne contaminated soils, direct dermal contact with exposed contaminated soils, and direct gamma irradiation from contaminated soils. These pathways, and the associated calculated potential risks are the result of elevated concentrations of contaminants (metals and radionuclides) in mining waste and spoils (soils) that are exposed at the surface.

The area around the Site is popular for recreational uses such as hiking, ATV/motorcycle use, hunting, and camping. In addition, the site is used by various Native American tribes for spiritual purposes. There is a potential for inhalation of airborne contaminated soils from such recreational and spiritual uses.

The highest risk potential scenarios (permit holder and recreational visitor) were used to back-calculate preliminary concentrations in soil that are protective of human health. This range of risk-based preliminary soil cleanup concentrations for radionuclides was presented in Section 5 of Portage (2006) for 10^{-4} , 10^{-5} and 10^{-6} risk levels assuming ingestion of beef/deer at 10%, 50% and 100% of the total meat source. Section 6.2 of the Final EE/CA (Pioneer 2006) presented preliminary risk-based soil concentrations for consideration at the Site for a risk level of 1×10^{-6} and assuming 100% beef ingestion (for arsenic) and 10% beef ingestion (for Ra-226).

The Portage (2006) risk assessment was reviewed by Tetra Tech for the USDA FS. The review included an evaluation of risk-based soil cleanup criteria developed at the Site and was used to identify any new COPCs. Additionally, the proposed risk-based cleanup levels were evaluated to assess whether they are still applicable and appropriate to the Site. The review determined that the 2006 Portage risk assessment was acceptable and no additional COPCs should be added. Additional conclusions are that using solely arsenic and Ra-226 soil cleanup concentrations during all future waste characterization and cleanup verification efforts will address other COPCs, such as uranium and thorium (Tetra Tech 2015d). Cleanup standards of 142 mg/kg for arsenic and 30 pCi/g for Ra-226 will be implemented at the site.

B. Threats to the Environment

Primary ecological receptors are the animal species that utilize the forage and water resources in the vicinity of the Site. The pathways by which ecological receptors could become exposed to contaminants at the Site are through direct contact with soils, ingestion of contaminated soils, direct contact with water and sediments, ingestion of water and sediments, and ingestion of contaminated food.

The Schleicht Draw reservoir was reported to have been a trout pond prior to mining in the 1960s. Ducks Unlimited developed a waterfowl pond downstream from the Schleicht Draw reservoir. The functionality of both water features have been diminished dramatically due to erosion and sedimentation leading to poor water quality. Aquatic life chronic surface water standards for arsenic and lead are exceeded for many of the sediment retention ponds located at the Site, while acute aquatic life water standards for copper are exceeded in all water sources at the Site, including Schleicht Draw reservoir and the Ducks Unlimited pond.

The presence of bare unvegetated soils and sediment deposits can partially be assumed as being the result of phytotoxic conditions.

A threat to the environment also exists through the migration of, and airborne exposure to contaminated dust. On dry windy days, dust may migrate to surface waters, wetlands, and other areas as the dust becomes airborne.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response actions selected in this Action Memorandum, may present an imminent and substantial endangerment to public health or welfare and/or the environment.

V. PROPOSED ACTION AND ESTIMATED COSTS

A. Proposed Action

1. Proposed Action Description

Proposed Action Background

The Final EE/CA (Pioneer 2006) evaluated six response action alternatives that address impacts associated with hazardous substances present at the site. The 2007 Action Memorandum (USFS 2007) created specific criteria for cleanup levels for reclamation at the site.

The six action alternatives from the Final EE/CA (Pioneer 2006) varied in the level of reclamation that would be completed, varying from no action (Alternative 1) to complete reclamation (Alternative 6). The Final EE/CA evaluated how each alternative

complied with Applicable or Relevant and Appropriate Requirements (ARARs). The USDA FS preferred response action for each of the study areas consisted of either Alternative 3 or Alternative 5 as documented in the Final EE/CA (Pioneer 2006). These preferred response actions were selected for all study areas in the 2007 and 2010 Action Memorandums (USFS 2007, USFS 2010).

Considerable additional waste characterization was completed at the Site following the release of the 2007 and 2010 Action Memorandums (USFS 2007, USFS 2010). The 2015 Final Waste Characterization Evaluation Report (Tetra Tech 2015d) reviewed and analyzed all data collected at the Site and the Verification Sampling Plan (Tetra Tech 2015e) provides guidance on the protocol for verifying that cleanup has been completed and to determine whether the risk-based cleanup levels have been met.

Waste Characterization Evaluation Report (Tetra Tech 2015d): provides data summaries and recommendations for further waste characterization and reclamation work at the Site. Following is a summary of the work completed in this report and discussed in this Action Memorandum:

- Perform a detailed review and summarize all relevant historical environmental studies, Action Memorandums, and scientific reports (including all existing waste characterization data) related to the Site.
- Review the Portage (2006) risk assessment, evaluate any risk-based soil cleanup criteria that have been developed at the site to date, and identify any new COPCs.
- Evaluate the proposed risk-based cleanup levels to assess whether they are still applicable and appropriate to the Site.
- Provide an update of the current reclamation and characterization status for all study areas and provide maps of most recent data collected within each study area.
- Determine if additional sampling is needed to fully characterize the study areas and provide recommendations as necessary.

Verification Sampling Plan (Tetra Tech 2015e): describes the data quality objectives, sampling approach, field activities, statistical methods, sampling location and frequency and quality assurance and quality control methods for all data collected at the site. The Verification Sampling Plan includes risk based cleanup levels and the analysis of the verification data to determine if the cleanup levels have been met.

On October 14, 2015 a legal notice was posted in the Rapid City Journal announcing the availability of Tetra Tech's Draft Waste Characterization Report and the Draft Verification Sampling Plan for public review and comment. Additional technical investigations were completed as part of the Riley Pass Uranium Mines Site action. A public meeting was conducted by the USDA FS that presented the analysis and recommendations of both the Draft Waste Characterization Report and the Draft Verification Sampling Plan to answer questions and receive public comments. The public comment period ended on November 18, 2015 and no public comments were received so both of these documents were finalized.

Table 2 below lists and compares the technical basis for the response actions from the Final EE/CA (Pioneer 2006) and the 2007 Action Memorandum (USFS 2007) to the analysis completed in the Waste Characterization Evaluation Report (Tetra Tech 2015d) and the Verification Sampling Plan (Tetra Tech 2015e).

Table 2- Comparison of Technical Basis for the Response Actions in Final EE/CA/2007 Action Memorandum to the 2015 Verification Sampling Plan and Waste Characterization Evaluation Report

Final EE/CA/ 2007 Action Memorandum	Verification Sampling Plan	Waste Characterization Evaluation Report	Comments
Risk Assessment – Final EE/CA Section 5.0 and Appendix D		Section 3.3 – Risk Assessment Evaluation, Appendix A	Concluded that the cleanup values appear protective of human health – validated Final EE/CA risk assessment
Risk-based cleanup levels and COPCs – Final EE/CA Section 6.0 2007 Action Memorandum Section V.A.1. – Proposed Action Description	Section 3.2 – Identify the Decision – risk- based cleanup levels	Section 3.3.1 and 3.3.2 – Identification of New COPCs and Appendix B	Concluded that cleanup levels and COPCs are still applicable and appropriate validated Final EE/CA and Action Memorandum
Verification of cleanup levels – 2007 Action Memorandum – Section V.A.1.e. stated there is a direct correlation between Ra-226 and arsenic concentrations, only measure gamma radiation for Ra-226	Verification Sampling Plan provides defensible and statistically sound approach	Section 3.2 – Summary of Existing Cleanup Standards Documents the acknowledgement that arsenic and Ra-226 are not directly correlated.	Requires XRF field surveys for arsenic and gamma radiation surveys for Ra-226 and soil confirmation sampling

Proposed General Site Reclamation

Based on the additional work conducted at the Site, reclamation techniques proposed in this Action Memorandum include response activities that enhance the approach described in the Final EE/CA (Pioneer 2006). This Action Memorandum documents the reclamation work to be completed and proposed changes in the approach to reclamation at the site, and documents the findings of the review of the 2006 Portage risk assessment and contaminants of potential concern (COPCs), risk-based cleanup levels, and verification sampling methods.

Alternative 6, as described in the Final EE/CA, contains the general approach for the proposed response activities at the Site, however, given the additional waste characterization work completed and the available funding, reclamation of the Site will be

conducted in a manner above and beyond that described in Alternative 6 to further address waste and stabilize the reclaimed areas. The revised proposed action for the Site detailed in this Action Memorandum is more protective of human health and the environment than outlined in the Final EE/CA (Pioneer 2006) and the 2007 Action Memorandum (USFS 2007).

The proposed action is to isolate the waste and reclaim the Site using natural landform mine reclamation techniques in an effort to restore the pre-mining hydrology, topography and productivity of the land at all study areas. Natural landform reclamation will recreate the various slope aspects and microsites for successful diverse vegetation and wildlife habitat. This approach allows for using on-site materials to reclaim steep slopes in a stable configuration and convey water and sediment discharge naturally in order to produce a self-maintaining natural landform.

The proposed action consists of isolation of waste and the implementation of the natural landform approach and applies the risk based cleanup levels specified below. The USDA FS has determined that implementing the proposed action in this way is expected to result in post-reclamation conditions at the Site that are materially consistent with the stated objectives of the Final EE/CA (Pioneer 2006) preferred alternatives, appropriate risk reduction requirements, and risk based cleanup level criteria established in this Action Memorandum by the USDA FS and the requirements of the NCP.

The cleanup criteria defined below will be protective of humans and ecological receptors from exposure to all contaminants (including the primary contaminants arsenic and Ra-226). The Verification Sampling Plan (Tetra Tech 2015e) allows for direct quantifiable measurements in the field for the verification of the cleanup during removal actions.

Analysis of sampling data for the Site concluded that measuring solely arsenic and Ra-226 soil cleanup concentrations for all future waste characterization and cleanup verification surveys will address all contaminants of potential concern which include the following:

- Arsenic: 142 mg/kg
- Molybdenum: 2,775 mg/kg
- U-238: 42.8 pCi/g
- U-234: 44.6 pCi/g
- U-235: 2.03 pCi/g
- Ra-226: 30.0 pCi/g

Risk-based cleanup levels for arsenic and Ra-226 in soils for the Riley Pass Site are as stated below. These site-wide risk-based cleanup criteria for arsenic and Ra-226 concentrations in soil will be applied for all future characterization and verification of cleanup attainment at the Riley Pass Site. The risk-based clean up criteria are as follows:

- Soils exceeding the risk-based cleanup criteria of 30 pCi/g. Ra-226 will be considered waste and isolated during reclamation activities.
- Soils exceeding the risk-based cleanup criteria of 142 mg/kg arsenic will be considered waste and isolated during reclamation activities.

Additional work included in the proposed action is the regrading and revegetating of numerous uranium exploration push pits, cleanout and maintenance of existing sediment ponds, construction of additional sediments ponds and erosion control structures, installation of water developments and pipelines, construction and reclamation of temporary access roads, laydown and storage areas for construction activities and other ancillary facilities necessary for the reclamation work at the Site.

Proposed Action Bluff Specific Reclamation

The Waste Characterization Evaluation Report (Tetra Tech 2015d) compiled all available and statistically valid characterization data and generated updated soil contaminant maps based on the risk-based cleanup standards that reflect the current conditions at each study area. Identification of waste at the Site is often an iterative process; much of the contaminated soil is not visually obvious (ie, disturbance, poor vegetation, etc) and therefore if waste is identified using the different innovative surveying techniques (i.e. XFR and gamma survey) and if the waste identified, exists at the edge of a sampling grid, additional sampling will be conducted to determine the extent of the contamination. A general update on the reclamation status and recommendations for additional characterization work is provided below for each study area.

Bluff A

No reclamation has been performed to date at Bluff A.

Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff A. Removal action at Bluff A is recommended to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels. Before a detailed removal action design for Bluff A is completed, additional characterization will be conducted to further discretize hot spots of contamination needed for removal action design.

Bluff B

Numerous erosion prevention actions have been conducted at Bluff B, however, no specific removal action has been conducted to date.

Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff B. A hydrologic analysis was performed on Bluff B to identify critical areas where drainages affect the contaminated zones. Bluff B has the highest density of potential stream networks of all the study areas evaluated. The hydrologic analysis identified numerous drainages that are directly affecting existing waste boundaries and have transported sediment off site. Additional XRF and gamma surveying within the affected drainages

is recommended. Removal action at Bluff B to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels will be completed. Before a detailed removal action design for Bluff B is completed, additional characterization, both surface and subsurface, will be conducted to further discretize hot spots of contamination needed for removal action design particularly areas on the northeast and eastern boundary of the study area.

Bluff CDE

No reclamation has been performed to date at Bluff CDE.

Reclamation was not recommended in the Final EE/CA (Pioneer 2006) based on the data available and the stable vegetation observed at Bluff CDE, however, the results of the Tetra Tech (2013b) study at Bluff CDE discovered arsenic and Ra-226 soil concentrations were the highest observed here out of all of the study areas. Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff CDE. While erosion is not a major concern for most of this study area, the high concentrations in soil of radionuclides and heavy metals necessitate a removal action to reduce the exposure to these contaminants below the risk-based cleanup criteria. Removal action at Bluff CDE will be completed to reduce the arsenic and Ra-226 concentrations below the risk-based soil cleanup levels. The transport of materials over the bluff edge from the bluff top is minor. Further investigation to locate and map the material off the bluff top will be conducted.

Bluff F

The USDA FS reclaimed two separate areas at Bluff F in 2012 under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011. A verification survey report outlining the removal action efforts during 2012 is presented in Tetra Tech (2013a). Removal action was successful at the western portion of Bluff F; however, cleanup attainment was not achieved at the northeastern portion of Bluff F (Tetra Tech 2013a), and further areas were identified that required removal. In 2014, under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-14-0010, final removal action and attainment of cleanup standards was achieved at Bluff F, as summarized in Tetra Tech (2015a); however, additional areas designated at Bluff F will require additional reclamation.

The results of the 2015 sampling showed there are areas exceeding arsenic and Ra-226 soil cleanup levels outside of the reclamation boundaries at Bluff F, and some areas exceeding the Ra-226 soil cleanup values within the existing reclamation boundaries. Attainment of the Ra-226 soil cleanup objectives within the reclaimed areas at Bluff F were previously determined to be successful (Tetra Tech 2013a; Tetra Tech 2015a); however, these were based on the correlation available at that time presented in MSE (2009). The Ra-226 data was evaluated using the more conservative Equation 2 in Section 4.2 of the Waste Characterization Evaluation Report (Tetra Tech 2015d). Because the areas at Bluff F were reclaimed to the cleanup objectives available at that time, no further action within the reclaimed areas at

Bluff F is recommended. Removal action at Bluff F outside of the previously reclaimed areas to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels will be completed.

Bluff G

The USDA FS reclaimed five separate areas at Bluff G under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-14-0010. These areas are on the bluff top and small in size. The verification arsenic XRF/soil sampling performed at the Bluff G reclaimed areas indicated that all the levels collected within these areas were below 142 mg/kg of arsenic. However, using geospatial interpolation techniques with all available data at Bluff G there are areas displayed within the reclaimed areas that exceed arsenic soil concentrations of 142 mg/kg. Attainment of the Ra-226 soil cleanup objectives at the reclaimed areas at Bluff G were previously determined to be successful (Tetra Tech 2015b). These previously reclaimed areas will likely be covered with clean material in the next removal action at Bluff G.

Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff G. Removal action at Bluff G will be conducted to reduce the arsenic and Ra-226 concentrations below the risk-based soil cleanup levels.

Bluff H

No reclamation has been performed to date at Bluff H.

A hydrologic analysis was performed on Bluff H to identify critical areas where drainages affect the contaminated zones. The hydrologic analysis identified numerous drainages that are directly affecting existing waste boundaries and have transported sediment off site. Additional XRF and gamma surveying within the affected drainages will be conducted, specifically within the drainage on the northern and eastern boundaries. Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff H. Removal action at Bluff H to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels will be completed. Before a detailed removal action design for Bluff H is completed, additional characterization, both surface and subsurface, will be conducted to further discretize hot spots of contamination needed for removal action design particularly areas on the northeast and eastern boundary of the study area.

Bluff I

Numerous reclamation activities have been conducted by the USDA FS at Bluff I, to varying degrees of success. Successful removal action at the eastern section of Bluff I was conducted in 2012 under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011, and the verification results are presented in Tetra Tech (2012a and 2012b). Additional removal action activities were conducted in 2013 and 2015 at the western and southern portions of Bluff I under Federal Contract Number GS-10F-0268K and Task Order AG-0355-D-11-0011, and the results are presented in

Tetra Tech (2013a) and Tetra Tech (2015a). The degree of success varies within the previously reclaimed areas as discussed in Tetra Tech (2013a and 2015a).

Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff I. Removal action at Bluff I to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels will be conducted.

Bluff J

Reclamation of Bluff J was performed in 2010. Using the Ra-226 cutoff limit established at the time (90 μ R/hr), a few relatively small areas were detected on Bluff J, which were in excess of the target concentration of 30 pCi/g Ra-226. In 2010, the USDA FS capped the radiation hot spots on the periphery of the Bluff J boundary with an average of 18 inches of cover soil. An elevated area of gamma and radium in the middle of a potential borrow area within Bluff J was not covered, as this area appeared undisturbed and was not likely to be used for soil borrow in the future. A total of 39 verification samples were collected at Bluff J as part of the 2010 verification survey. All samples were below the arsenic cleanup criteria. Consolidated mine waste and spoils materials on Bluffs J were sufficiently covered with clean borrow soil to reduce arsenic concentrations at the surface to less than 142 mg/kg. Cleanup attainment was achieved at Bluff J after the 2010 reclamation, as summarized in MSE (2010c).

There is a hot spot of Ra-226 contamination remaining at Bluff J; however, this study area was determined to meet the attainment objectives used at the time it was reclaimed (MSE 2010c). A reevaluation of the Ra-226 soil concentrations at Bluff J will be completed using the Verification Sampling Plan (Tetra Tech 2015e) for the Site.

Bluff K

The USDA FS performed reclamation at Bluff K in 2010. Two small, slightly elevated areas bordering the south edge of the borrow area contained gamma measurements that exceeded 90 μ R/hr. However, these areas did not exceed the cleanup goal of 30 pCi/g; therefore, no cover soil was added to these areas. An XRF field survey was performed by MSE in 2010 to verify attainment of cleanups standards. The results of this verification survey showed that four point measurements of arsenic exceeded the cutoff value of 142 mg/kg; however, in general the cover soils appear to be below the cleanup goal established for arsenic at the Site. Consolidated mine waste and spoils materials on Bluff K have been sufficiently covered with clean borrow soil to reduce arsenic concentrations at the surface to less than 142 mg/kg. Cleanup attainment was determined to be successful based on the criteria established at the time of verification survey was performed at Bluff K as summarized in (MSE 2010c).

The characterization and verification survey data at Bluff K is inadequate to determine if attainment of cleanup objectives for arsenic has been achieved. Further investigation at Bluff K for arsenic will be conducted.

Bluff L

No reclamation has been performed to date at Bluff L.

Dispersed areas of arsenic and Ra-226 soil contamination remain at Bluff L. Removal action at Bluff L to reduce the arsenic and Ra-226 concentrations below the soil cleanup levels will be conducted. Before a detailed removal action design for Bluff L is completed, additional characterization will be conducted to further discretize hot spots of contamination needed for removal action design particularly areas on the northeast and eastern boundary of the study area.

a. Addresses Identified Human Health and Environmental Threats

Isolating the waste and reclaiming the site using natural landform mine reclamation techniques, including revegetation of the bluffs at the site will result in the development of a vegetative barrier between the human/environmental receptor and the waste materials, and will prevent migration of these materials from the Site. Removal and isolation of waste and re-grading the slopes is an appropriate response because it will stabilize waste and soils and prevent sediment from migrating into the surface waters or coming into contact with humans or environmental receptors at unacceptable risk levels.

Given the complex mineralogical make-up of the study areas and the corresponding background concentrations of certain metals and radioactive elements, the appropriate protective human health risk value for the area based on background arsenic conditions and scenarios described in the Final EE/CA (Pioneer 2006), is 2×10^{-5} . The cleanup criteria selected by the USDA FS will result in a more protective post-reclamation risk level of 1×10^{-5} .

A Ra-226 soil concentration of 30 pCi/g is protective to the 1×10^{-5} risk level for the most exposed individual described in the EE/CA (Permit Holder based on a 10% locally produced beef consumption scenario). This arsenic concentration in soil conservatively results in an estimated risk to the Permit Holder of 1×10^{-5} .

Exposures of ecological receptors at the site will also be risk-protective with the implementation of the 30 pCi/g Ra-226 and the 142 mg/kg arsenic concentrations soil cleanup. U.S. EPA recently published arsenic Eco-Soil Screening Levels (SSL) for protection of representative species of birds and mammals (March 2005). These SSLs support the selected criteria and cleanup levels. For birds the conservatively protective arsenic EcoSSLs range from 43 mg/kg (protective of an avian insectivore consuming all food from a confined area) to 1100 mg/kg for an avian carnivore. Similarly, for mammals, the range is 46 mg/kg for an insectivore confined to the area to 170 mg/kg for carnivores. The proposed action will result in average arsenic concentrations at or below 142 mg/kg in the most contaminated areas, and well below this concentration across the entire ecological exposure area.

b. Justification for Proposed Response

The USDA FS proposed response actions for the Site consists of isolation of waste and reclaiming the Site using natural landform mine reclamation techniques. This response was selected for the various areas within the Site because it reduces post-reclamation exposures and risks to levels that are well within the range defined by U.S. EPA as protective of human health and the environment and provides the best combination of effectiveness, ability to implement, and cost.

Re-vegetation will be accomplished by using clean borrow to cover mine wastes and spoils, applying organics and fertilizer and seeding with an acceptable seed mix ensure continued stabilization of the site and protection to human health and the environment.

c. Technical Feasibility and Probable Effectiveness

The proposed action will effectively reduce exposure levels as well as contaminant mobility at the Site by establishing a barrier between materials with contaminants at concentrations above risk-based cleanup levels and the human/environmental receptor. The response actions for the various areas are technically and administratively feasible. The actions will reduce the human health risks to the 1×10^{-5} level which is protective under U.S EPA standards, and appropriate for this site given the fact that the natural background conditions (due to the complex mineralization of the area) constitute human health risks at a level greater than 1×10^{-6} . Key project components such as equipment, materials, and construction expertise, although distant from the Site, are available and would allow the timely implementation and successful execution of the alternatives.

Stabilizing and isolating contaminated soils and sediment will effectively eliminate pathways for human health risks such as inhalation/ingestion of contaminated soils and sediment, dermal contact with the contaminated material and gamma irradiation from direct exposure to the contaminated material. This action will require little maintenance and provide long-term effectiveness.

d. Further Information

No further information is needed to select the proposed action.

e. Verify Extent of Contamination

The Verification Sampling Plan dated November 18, 2015 developed by Tetra Tech for the USDA FS (Tetra Tech 2015e) will be used to identify the extent of contamination and verify that an area has been cleaned up. The Verification Sampling Plan presents the cleanup verification survey methodology that will be performed after removal action has been completed, to assess whether the risk-based soil cleanup criteria have been attained for the Site.

The methodology presented in this report allows for a phased approach in the likely event that the removal action is carried out in a phased approach. In addition to assessing whether cleanup criteria have been attained, a secondary goal of the surveys is to provide detailed information on the spatial extent of concentrations in soil that remain at each area after removal actions have been conducted. The simultaneous characterization of concentrations in soil will provide useful data in the event cleanup objectives are not attained and additional removal action is necessary, thus providing significant cost savings by eliminating the need to return to this remote site for characterization.

f. Sensitive Environments

Increased sedimentation may result during the implementation of the action at the Site. These impacts can be mitigated by limiting the construction period to the drier months of the year and by implementing best management practices for storm water runoff. Since the Site and surrounding locations are known to contain a high heritage site density, areas of new disturbance must be reviewed and approved by a USDA FS approved consultant or the Forest Archeologist prior to initiation of reclamation work.

g. Access

The USDA FS has access into the North Cave Hills across the Tufte, Welch Fire Trail and Brown Johnson Roads. Access roads will be maintained during the construction season. Any temporary access roads will be reclaimed at the completion of construction. The USDA FS will seek an access agreement for any access across private property.

h. Uncertainties

Uncertainties associated with implementing these actions are limited to the uncertainty of knowing the exact volumes of the contaminated soils and sediment that will be addressed or isolated.

Following construction, a temporary 4-strand barbed wire fence may be constructed around the perimeter of reclaimed areas to protect against livestock and vehicle damage. The fencing will be removed once the area is re-vegetated.

Appropriate control measures will be instituted, such as recording a summary of the removal actions in land status documents and deed notices to notify potential users and possible future land purchasers of onsite hazards. These, and other control measures, will be reviewed and could be revised during future actions taken at the Site.

j. Off-Site Disposal

Off-site disposal was considered in the EE/CA (Pioneer 2006), but was not brought forward for further evaluation since the contaminated materials are being disposed of

on-site and the benefits of transporting the material off-site would not justify the prohibitively high costs.

k. Post-Removal Site Controls

Post-removal site controls will be required. An operation, monitoring, and maintenance plan will be prepared to define these controls. Post-removal site control at excavation and re-grading sites will involve monitoring to identify any problems with revegetation, drainage, or erosion.

l. Changes Resulting from Public Comments

No written comments were received on the Draft Verification Sampling Plan (Tetra Tech, 2015), therefore no changes were made to the draft and a final Verification Sampling Plan was issued in November 2015 (Tetra Tech 2015e).

2. Short-Term Impacts

The major short-term impact to the closest community, residents, recreational users, and wildlife involves increased vehicle traffic and temporary delays to passage on various roadways surrounding the site. An increase in traffic will occur during mobilization and demobilization of construction equipment. Travel delays may also be necessary during removal action work. Increased traffic may impact wildlife by either changing their daily migration patterns or exposing them to a higher potential for injury or death due to collisions with vehicles.

3. Contribution to Removal Performance

The selected removal actions will likely be followed by other actions in the Site area. These removal actions are intended to mitigate all the mining impacts at the Site. This source stabilization and removal will address sediment impacts to surface water, and, in combination with the sum of all response actions for the overall site, is expected to meet project goals, objectives, and ARARs to the extent practicable. In addition the proposed action will lower the risk to human health and the environment. The proposed action will not impede future responses based on available information.

4. Description of Alternative Technologies

General response actions potentially capable of achieving response action objectives and goals were screened in the EE/CA (Pioneer 2006). These included no action, institutional controls, engineering controls, excavation and treatment, and in-situ treatment.

a. Institutional Controls

Institutional controls include land use and access restriction. Institutional controls by themselves will not prevent migration of the contaminants off-site through surface water, or air. Therefore, institutional controls as a separate alternative were not

considered by themselves in detail. However, institutional controls as components of other alternatives were considered.

b. Engineering Controls

Engineering controls limit the release or threat of release of hazardous substances generally by limiting mobility through isolation, and/or by limiting physical processes necessary for mobility. These measures included removal, containment, chemical fixation, and surface controls. All of these measures were incorporated into the alternatives considered for the Site.

c. Waste Disposal

Waste disposal options are used as a source control measure by placing contaminated media in a waste disposal area. The Final EE/CA (Pioneer 2006) evaluated excavation of the contaminated soils and sediment for disposal in an on site engineered repository. However, due to the remoteness of the Site and the large volumes of material in question, the Final EE/CA (Pioneer 2006) did not evaluate the excavation of the contaminated material for transport and placement in an off-site engineered repository. Waste disposal areas will be considered for on-site disposal of waste.

d. Miscellaneous Alternatives

No evaluation was conducted for technologies that directly address surface water because water treatment technologies are beyond the scope of this phase of the response action. The removal of solid wastes from contact with the environment makes it likely that a reduction in contaminant concentrations will occur in surface water and streambed sediments.

Various response actions and technology types were evaluated but rejected due to a variety of reasons including uncertainties in effectiveness and high cost. These response actions included on-site reprocessing of the material to extract residual mineralization. The concentrate generated by reprocessing would be shipped off-site for processing, while byproducts of reprocessing would be consolidated and placed in an on-site repository, amended, if necessary, and revegetated.

5. Engineering Evaluation/ Cost Analysis (EE/CA)

Pioneer Technical, on contract to the UDSDA FS, prepared the Final EE/CA (Pioneer 2006) that details site characteristics and identifies, develops, and evaluates alternatives. This undertaking was accomplished with substantial input from USDA FS specialists who analyzed the effects of the alternatives identified in the Final EE/CA (Pioneer 2006) and considered public comments. This Final EE/CA (Pioneer 2006) was used as a basis for all work at the Site.

Alternative 6 as described in the Final EE/CA (Pioneer 2006) contains the general approach for the proposed reclamation at the Site, however given the additional waste

characterization work and available funding for the reclamation of the Site, natural landform reclamation would be conducted in a manner above and beyond that described in Alternative 6 to further address the waste at the site and stabilize the reclaimed areas.

6. Applicable or Relevant and Appropriate Requirements (ARARs)

Section 300.415(i) of the National Contingency Plan (NCP) and guidance issued by the Environmental Protection Agency (EPA) require that removal actions attain ARARs under federal or state environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal (EPA, 1993). In addition to ARARs, the lead Agency may identify other federal or state advisories, criteria, or guidance to be considered for a particular release.

ARARs are categorized as either applicable or relevant and appropriate. Applicable requirements are those standards, requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant found at a site. Relevant and appropriate requirements are those standards, requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that are not applicable to a particular situation but apply to similar problems or situations, and therefore may be requirements for a response action to address.

The following tables identify those ARARs that were evaluated during the development of the Final EE/CA (Pioneer 2006), and presents the USDA FS final determination of ARARs for the proposed action.

The USDA FS reviewed the alternatives for the removal actions relative to the ARARs and has determined that the selection of the preferred alternatives is consistent with the final ARARs presented below.

**FEDERAL ARARs FOR THE RILEY PASS PROJECT
FEDERAL- CHEMICAL SPECIFIC**

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status
<u>Ambient Water Quality Criteria</u>	40 CFR Part 131 Quality Criteria for Water 1976,1980, 1986	Sets criteria for water quality based on toxicity to aquatic organisms and human health.	Not an ARAR for the actions being considered for this project
<u>Soils Cleanup Criteria</u>	40 CFR Part 192 Subpart B	This citing sets guidelines for the cleanup of sites that were used to process Uranium ores and as a result generated mill tailings that contain radio-nuclides. The actions proposed for this site are based on site-specific risk based clean up goals.	Not an ARAR for the actions being considered for this project
<u>Exposure Limits for Radioactive Wastes</u>	40 CFR Part 190 (10 CFR 20.1301)	Sets radiation exposure limits to the public	Relevant and Appropriate

FEDERAL- LOCATION SPECIFIC

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status
<u>National Historic Preservation Act</u>	16 USC § 470; 36 CFR Part 800; 40 CFR 6.310(b)	Requires Federal Agencies to take into account the effect of any Federally-assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places and to minimize harm to any National Historic Landmark adversely or directly affected by an undertaking.	Applicable
<u>Archaeological and Historic Preservation Act</u>	16 USC § 469; 40 CFR § 6.301(c)	Establishes procedures to provide for preservation of historical and archaeological data, which might be destroyed through alteration of terrain, as a result of a Federal construction project or a Federally licensed activity or program.	Applicable
<u>Historic Sites, Buildings and Antiquities Act</u> <i>Appendix A, Executive Order</i>	16 USC §§ 461-467; 40 CFR § 6.301(a)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	Applicable

Requirement Criteria Or Limitation			
<i>No. 11, 990</i>			
<u>Protection of Wetlands Order</u>	40 CFR Part 6, Appendix A, Executive Order No. 11,990	Avoid adverse impacts associated with destruction or loss of wetlands and avoid support of new construction in wetlands if a practicable alternative exists.	Applicable
<u>Fish and Wildlife Coordination Act</u>	16 USC §§ 2901-2912; 40 CFR Part 6.302(g)	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body and adequate provision for protection of fish and wildlife resources.	Applicable
<u>Floodplain Management Order</u>	40 CFR Part 6	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct development of a floodplain. (Only substantive portions are applicable to on-site actions)	Applicable
<u>Endangered Species Act</u>	16 USC §§ 1531-1543; 40 CFR 6.302(h); 50 CFR Part 402	Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Applicable
<u>Migratory Bird Treaty Act</u>	16 USC §§ 703	Establishes a federal responsibility for the protection for the international migratory bird resource and requires consultation with the USFWS during reclamation design and reclamation construction to ensure the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigation measures may be identified for compliance with this requirement. (Only substantive portions are applicable to on-site actions)	Applicable
<u>Resource Conservation and Recovery Act</u> Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes performance criteria for solid waste disposal facilities and practices to avoid adverse effects on health or the environment	Relevant and Appropriate (For issues pertaining to the design and construction of a suitable repository)

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status
<u>Clean Water Act</u> National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 122.26	Requires permits for the discharge of pollutants from any point source into waters of the United States. The State of South Dakota has been delegated authority to implement the Clean water Act and enforces these through the Surface Water Discharge System. Sites under CERCLA are required to meet the substantive requirements of the permit but do not have to obtain an actual permit	This is not an ARAR for the actions being taken at this site because the action will not cause a point source discharge.
<u>Hazardous Materials Transportation Act</u> Standards Pertaining to Transporters of Hazardous Waste	49 CFR Parts 106-180	Regulates the transport of hazardous waste by rail, aircraft, vessel, or public highways. This includes metals that are listed under CERCLA.	Relevant and Appropriate (If work utilizes State or County highways)
<u>Resource Conservation and Recovery Act</u> Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Parts 264.116 through 264.310	Establishes minimum national standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store, or dispose of hazardous waste. Because of the Bevill Amendment for mine wastes these regulations can not be considered applicable and only substantive portions of the regulations are relevant and appropriate to on-site actions)	Relevant and Appropriate (For issues pertaining to the design and construction of a suitable repository)

STATE CONTAMINANT SPECIFIC

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status for the Riley Pass Project
<u>Drinking Water Standards</u>	ARSD 74:04:05	Established the MCLs for public water systems. These standards are not applicable because they apply to community water supply systems.	(See Note# 1 below)
<u>Regulated Substances</u>	ARSD 74:34:01:02	Prohibits the un-permitted release of regulated substances to the environment. No person may discharge to the environment a regulated substance listed in § 74:34:01:03 except pursuant to and in compliance with the conditions of a federal or state permit or by activities allowed by federal or state law or rule. The mixture of a listed regulated substance with a non-regulated substance subjects the mixture to full regulation under this chapter.	(See Note# 1 below)
<u>Ambient Air Quality Standards</u>	ARSD 74:36:02:01	Establishes air quality guidelines.	Relevant and Appropriate

Requirement Criteria Or Limitation			
	ARSD 74:36:02:02	Establishes ambient air quality standards. South Dakota has adopted the ambient air quality standards listed in 40 C.F.R. §§ 50.1 to 50.12, inclusive (July 1, 1997), except as revised in publication 62 Fed. Reg. 38711 to 38712 and 38894 to 38895 (July 18, 1997). They define the types and levels of air pollution above which the ambient air would limit the attainment of the goals specified in § 74:36:02:01. These standards apply to the entire state of South Dakota, and no person may cause these standards to be exceeded. The standards stated in 40 C.F.R. §§ 50.1 to 50.12, inclusive (July 1, 1997), except as revised in publication 62 Fed. Reg. 38711 to 38712 and 38894 to 38895 (July 18, 1997), include normal background levels of air pollutants.	Relevant and Appropriate
<u>Surface Water Quality Standards</u>	ARSD 74:51:01	Establishes water quality standards for surface water in the state of South Dakota.	
	ARSD 74:51:01:02	Requires compliance with the criteria of a designated beneficial use. A person may not discharge or cause to be discharged into surface waters of the state pollutants that cause the receiving water to fail to meet the criteria for its designated beneficial use or uses.	(See Note# 1 below)
	ARSD 74:51:01:05	Prohibits materials causing pollutants to form in waters. Wastes discharged into surface waters of the state may not contain a parameter that violates the criterion for the waters' existing or designated beneficial use or impairs the aquatic community as it naturally occurs. Where the interaction of materials in the wastes and the waters causes the existence of such a parameter, the material is considered a pollutant and the discharge of such pollutants may not cause the criterion for this parameter to be violated or cause impairment to the aquatic community.	(See Note# 1 below)

Standard,	Citation	Description	ARAR Status for the Biden-Bass Project
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Criteria Or Limitation			
	ARSD 74:51:01:06	Prohibits visible pollutants. Raw or treated sewage, garbage, rubble, un-permitted fill materials, municipal wastes, industrial wastes, or agricultural wastes which produce floating solids, scum, oil slicks, material discoloration, visible gassing, sludge deposits, sediments, slimes, algal blooms, fungus growth, or other offensive effects may not be discharged or caused to be discharged in surface waters of the state.	(See Note# 1 below)
	ARSD 74:51:01:07	Establishes that no materials may be discharged or caused to be discharged which affect the pH of the receiving waters by more than 0.5 pH units. This does not apply to pH fluctuations of more than 0.5 pH units attributable to natural influences.	(See Note# 1 below)
	ARSD 74:51:01:08	Prohibits taste- and odor-producing materials. Materials which will impart undesirable tastes or undesirable odors to the receiving water may not be discharged or caused to be discharged into surface waters of the state in concentrations that impair a beneficial use.	(See Note# 1 below)
	ARSD 74:51:01:11	Establishes for the protection of wetlands as surface waters of the state. The discharge of pollutants from any source, including indiscriminate use of fill material, may not cause destruction or impairment of wetlands	(See Note# 1 below)
	ARSD 74:51:01:12	Establishes criteria for the biological integrity of surface waters of the state. All waters of the state must be free from substances, whether attributable to human-induced point source discharges or non-point source activities, in concentrations or combinations which will adversely impact the structure and function of indigenous or intentionally introduced aquatic communities.	(See Note# 1 below)

Standard, Requirement	Citation	Description	ARAR Status for the Riley Pass Project
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Limitation			
	ARSD 74:51:01:14	Establishes allowable concentrations of radioactive iodine, radium, strontium, and tritium. The average dissolved concentrations including the naturally occurring or background concentrations of iodine-131, radium-226, strontium-89, strontium-90, and tritium may not exceed the following concentration limits: iodine-131, 5 pCi/L; radium-226, 5 pCi/L; strontium-89, 100 pCi/L; strontium-90, 10 pCi/L; and tritium, 300 pCi/L.	(See Note# 1 below)
	ARSD 74:51:01:15	Establishes allowable concentrations of miscellaneous radionuclides. For all radio nuclides not listed in § 74:51:01:14, the average dissolved concentration limits in surface waters of the state are 1/150 of the corresponding maximum permissible concentration in water for continuous occupational exposure for a 168-hour week as contained in pages 24 to 91, inclusive, of Handbook 69.	(See Note# 1 below)

Standard, Requirement	Citation	Description	ARAR Status for the Riley Pass Project
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	ARSD 74:51:01:16	<p>Establishes that where there is a mixture of dissolved radionuclides in surface waters of the state, the following relationship must be satisfied:</p> $\frac{C}{L} + \frac{C}{L} + \dots + \frac{C}{L} = 1.00$ <p>With C denoting the average concentration or the respective radionuclide and L denoting its concentration limit established in § 74:51:01:14 or 74:51:01:15.</p>	(See Note# 1 below)
	ARSD 74:51:01:18	<p>Establishes criteria for suspended radionuclides. For radionuclides associated with suspended materials in the water, the average concentration limits are 1/150 of the corresponding maximum permissible concentration in water (insoluble form) for continuous occupational exposure for a 168-hour week as contained in pages 24 to 91, inclusive, of Handbook 69. In stream sedimentation of those materials may not produce solids beds and result in noncompliance, because of leaching, with the provisions of § 74:51:01:14, 74:51:01:15, or 74:51:01:16.</p>	(See Note# 1 below)
	ARSD 74:51:01:19	<p>Establishes that the maximum concentration for any one sample may not exceed three times the average concentration limits of radio nuclides specified in §§ 74:51:01:14 to 74:51:01:18, inclusive.</p>	(See Note# 1 below)
	ARSD 74:51:01:34	<p>Establishes the anti-degradation policy for surface waters of the state.</p>	(See Note# 1 below)
	ARSD 74:51:01:38	<p>Establishes policy for anti-degradation of water quality reviews for non-point source discharges to surface waters of the state. Non-point sources shall be reviewed as feasible by the board. Non-point source discharges shall be controlled utilizing cost-effective methods and reasonable best management practices.</p>	(See Note# 1 below)
	ARSD 74:51:01:42	<p>Establishes the beneficial uses of surface waters of the state. The beneficial use classification of surface waters of the state established in this</p>	(See Note# 1 below)

Standard, Requirement Criteria Or	Citation	Description	ARAR Status for the Riley Pass Project
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		section are not to be construed as limiting the actual use of such waters. The classification designate the minimum quality at which the surface waters of the state are to be maintained and protected.	
	ARSD 74:51:01:52	Establishes criteria for wildlife propagation and stock watering waters.	(See Note# 1 below)
	ARSD 74:51:01:55	Establishes toxic pollutant criteria. Toxic pollutants at levels which are or may become injurious to public health, safety, or welfare; plant, aquatic, and animal life; or the existing or designated uses of waters may not be present in the surface waters of the state. The toxic pollutants to which this section applies are the priority pollutants and chemicals in 40 C.F.R. Part 131 (July 1, 1995) and any other toxic pollutants or substances determined by the secretary to be of concern at a specific site. Appendix B at the end of this chapter lists the priority pollutants and chemicals for which specific numerical criteria have been adopted by the board. The limits at the site are based on risk based values and may over shadow set levels. However the citation gives guidance for the issue	(See Note# 1 below)
<u>Uses Assigned to Streams</u>	ARSD 74:51:03	Establishes the uses assigned to streams in the state.	

Standard, Requirement Criteria Or	Citation	Description	ARAR Status for the Riley Pass Project
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	ARSD 74:51:03:01	Establishes that the beneficial uses of South Dakota streams include irrigation and wildlife propagation and stock watering. All streams in South Dakota are assigned the beneficial use of irrigation and wildlife propagation and stock watering.	
<u>Groundwater Quality Standards</u>	ARSD 74:54:01	Establishes the maximum concentration limits for groundwater in the state of South Dakota.	
	ARSD 74:54:01:04	Establishes standards for groundwater of 10,000 mg/L TDS concentration or less.	This ARAR is outside the scope of this removal action so it will not be dealt with during this action.
	ARSD 74:54:01:05	(Applicable) specifies that groundwater shall not contain potential toxic pollutants. Potential toxic pollutants must be non-detectable in groundwater at detection limits of the currently acceptable sampling and analytical techniques as approved by the secretary in § 74:03:15:05 until a maximum contaminant level (MCL) is set by the EPA.	This ARAR is outside the scope of this removal action so it will not be dealt with during this action.

Note# 1- South Dakota has designated uses (wildlife and livestock watering) and as such establishes certain water standards for Schleicht Draw and Pete's Creek. Consolidating and capping waste material at the site will reduce storm-related non-point source loading to these tributaries. However, achieving designated uses and stream standards is beyond the scope of this source control removal action. Furthermore, construction-related impacts will be temporary and all reasonable efforts will be made to minimize the impacts of the removal actions.

STATE- LOCATION SPECIFIC

Standard, Requirement	Citation	Description	ARAR Status for the Riley Pass Project
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Limitation			
<u>Wetlands as Surface Waters</u>	ARSD 74:51:01:11	Established for the protection of wetlands as surface waters of the state. The discharge of pollutants from any source, including indiscriminate use of fill material, may not cause destruction or impairment of wetlands	(See Note# 1 below)

STATE- ACTION SPECIFIC

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status for the Riley Pass Project
<u>Mined Land Reclamation</u>	SDCL 45-6B-37	Final grading requirements.	Relevant and Appropriate
	SDCL 45-6B-39	In those areas where revegetation is part of the reclamation plan, land shall be revegetated in such a way as agreed upon by the operator, the local conservation district and the landowner which establishes a diverse, effective and long-lasting vegetative cover that is capable of self-regeneration and at least equal in extent of cover to the natural vegetation of the surrounding area.	Relevant and Appropriate
	SDCL 45-6B-40	Requirements for the removal and handling of topsoil.	Relevant and Appropriate
	SDCL 45-6B-41	Reclamation operations must be planned and conducted to minimize disturbance to the prevailing hydrologic balance and to prevent material damage to the prevailing hydrologic balance.	Relevant and Appropriate
	SDCL 45-6B-42	Protection from slides subsidence or damage and control of high walls.	Relevant and Appropriate
	SDCL 45-6B-43	All surface areas shall be stabilized and protected to effectively control erosion and air and water pollution.	Relevant and Appropriate
	SDCL 45-6B-44	Establishes requirements for the proposed reclamation plan, including copies to adjacent landowners, approval of the plan, consultation with the landowner and local authorities and the reclamation of all affected land	Relevant and Appropriate

Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status for the Riley Pass Project
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Solid Wastes		disposal sites must meet. These requirements apply to any person involved in any aspect of the management of solid waste and rubble sites, including recycling, processing transporting, storing, or disposing of solid waste.	the site
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Standard, Requirement Criteria Or Limitation	Citation	Description	ARAR Status for the Riley Pass Project
Reclamation	ARSD 74:20:05:12	Establishes criteria for the reclamation of	This is not an ARAR for

<u>Of Tailings Which Cannot Meet Treatment Standards</u>		standards. Tailings which have been treated and cannot meet the criteria established in § 74:29:05:08 or which cannot feasibly be treated shall be reclaimed so that infiltration into, percolation through, and discharge from such tailings are minimized. Discharges from tailings must comply with the provisions of a groundwater discharge plan pursuant to chapter 74:54:02 or a surface water discharge permit pursuant to chapter 74:54:01, as applicable. The reclamation plan for such tailings disposal sites and tailings disposal practices shall be based on a detailed pathway and fate analysis augmented by engineering plans and specifications and monitoring data. Revegetation must comply with the general reclamation requirements of § 74:29:07:06.	
<u>Minimum Reclamation Requirements</u>	ARSD 74:29:07:01	Establishes the general requirements for all reclamation types.	Relevant and Appropriate
	ARSD 74:29:07:03, and 04	Gives general backfilling, and grading requirements.	Relevant and Appropriate
	ARSD 74:29:07:06	Specifications for the vegetative cover and performance are provided.	Relevant and Appropriate
	ARSD 74:29:07:07	Establishes the requirements for topsoil management during mining activities in addition to SDCL 45-6B-40.	Relevant and Appropriate
	ARSD 74:29:07:08	Reclamation operations must be planned and conducted to minimize disturbance to the prevailing hydrologic balance and to prevent material damage to the prevailing hydrologic balance.	Relevant and Appropriate
	ARSD 74:29:07:18	Establishes the requirements for specific types of reclamation.	Relevant and Appropriate
	ARSD 74:29:07:20	Rangeland planting requirements.	Relevant and Appropriate
	ARSD 74:29:07:22	Post mining wildlife requirements.	Relevant and Appropriate
	ARSD 74:29:07:23	Post mining reclamation requirements.	Relevant and Appropriate
	ARSD 74:29:07:27	Post mining permanent surface impoundment.	Relevant and Appropriate

7. Project Schedule

Implementation of the proposed action will begin immediately following execution of this Action Memorandum. Construction is expected to begin in spring/summer, 2016.

require fifteen to twenty years to complete.

8. References

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MSE. 2010b. Verification Sampling Plan, Riley Pass Uranium Mines Site Removal Action Non-Tronox Bluffs (A, F, I1, I-2, I3, J1, J2, K1, K2), USDA Forest Service, Custer National Forest (North CaveHills), Harding County, South Dakota. MSE. 15p.

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Tetra Tech. 2012b. Tronox Bluffs Waste Characterization Sampling and Analysis Plan, Riley Pass Abandoned Uranium Mines Site North Cave Hills, Harding County, South Dakota. November 7,

Tetra Tech. 2013a. Cleanup Verification Survey Report for Riley Pass Abandoned Uranium Mines Site Non-Tronox Bluffs F1, F2, I3 and I1, Radiological Survey, Riley Pass Uranium Mines Site (North Cave Hills), Harding County, South Dakota. Prepared for USDA – Forest Service, March 12, 2013. Tetra Tech. 47p.

Tetra Tech. 2013b. Tronox Bluff Waste Characterization Report, Riley Pass Abandoned Uranium Mines Site North Cave Hills, Harding County, South Dakota. Prepared for USDA – Forest Service, June 27, 2013. Tetra Tech. 187p.

Tetra Tech. 2015a. Cleanup Verification Survey Report for Riley Pass Abandoned Uranium Mines Site Non-Tronox Bluffs F2, I1-5, I1-6, I1-7, I1-8; Spoils Piles A, B, and C Gamma Radiation Survey and XRF Field Survey, Riley Pass Uranium Mines Site (North Cave Hills) Harding County, South Dakota. April 20, 2015. Tetra Tech. 71p.

Tetra Tech. 2015b. Cleanup Verification Survey Report for Riley Pass Abandoned Uranium Mines Site Tronox Bluffs G1, G2, G3, G4, and G5, Gamma Radiation Survey and XRF Field Survey, Riley Pass Uranium Mines Site (North Cave Hills) Harding County, South Dakota. April 20, 2015. Tetra Tech.

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B. Estimated Costs

The preliminary estimated cost to implement this action is \$150,000,000, including design, construction oversight, and post-removal site control.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN.

If no action is taken to stabilize and isolate waste materials and to eliminate surface exposures of wastes with concentrations of contaminants the USDA FS has determined exceed risk-protective levels, contaminated sediment from the site will continue to impact the surrounding environment. This situation along with the continued exposure of human and environmental receptors to these materials will present an unacceptable risk to human and ecological receptors.

VII. OUTSTANDING POLICY ISSUES

The study areas (i.e. bluffs) at the Site had been previously delineated as either "Tronox" or "Non-Tronox," identifying each study area as attributable to Tronox as the potentially responsible party (PRP) or Non-Tronox if there was no PRP. Tronox, LLC, was the PRP for approximately 80 percent of the site. In 2008, Tronox informed the USDA FS that it was stopping all work on the project, in violation of the consent order Tronox had signed in the previous year. In 2009, Tronox filed Chapter 11 bankruptcy. The Site was one of many included in a bankruptcy settlement agreement that created environmental response trusts and provided for Tronox to pay the trusts and Governmental Environmental Claimants. A series of court proceedings resulted in a payment to clean up the Site. That settlement

was announced by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Justice (DOJ) and approved by a judge in April 2014 (O'Sullivan 2014).

This settlement resolved all of the liabilities of the PRPs, Tronox and Kerr McGee Corporation. The Tronox Bluffs were previously referred to as Bluff B, Bluff CDE, Bluff G, and Bluff H. The Non-Tronox Bluffs were previously referred to as Bluff A, Bluff F, Bluff I,

VIII. ENFORCEMENT

The USDA FS will be the "lead agency" for all response actions occurring on National Forest System Lands, as defined by the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR part 300, and all response actions will be undertaken in a manner consistent with the NCP.

IX. APPROVAL

This decision document represents the selected removal action for the Riley Pass Uranium Mines Site for all mining disturbances occurring at the Site in Harding County, South Dakota within the Custer Gallatin National Forest, Harding County, South Dakota, developed in accordance with CERCLA as amended, and consistent with the NCP. This decision is based upon the administrative record for the site.

Conditions at the Riley Pass Uranium Mines Site meet the NCP Section 300.415(b)(2) criteria for a removal, and I recommend your approval of the removal action:

MaryBeth Marks
Mary Beth Marks
On-Scene-Coordinator

May 9, 2016
Date

I concur with the recommendation to implement the proposed action as described in this Action Memorandum for all mining disturbances at the Riley Pass Site in Harding County, South Dakota:

Kurt Hansen
Kurt Hansen

5-9-2016
Date

I concur with the recommendation to implement the proposed action as described in this Action Memorandum for all mining disturbances at the Riley Pass Site in Harding County, South Dakota:

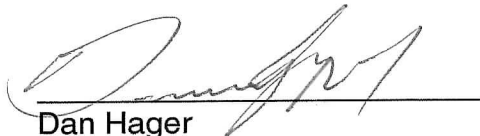


Mary Erickson
Forest Supervisor
Custer Gallatin National Forest

5-9-2016

Date

I concur with the recommendation to implement the proposed action as described in this Action Memorandum for all mining disturbances at the Riley Pass Site in Harding County, South Dakota:

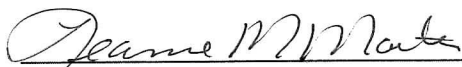


Dan Hager
Director of Engineering
USDA-FS Northern Regional Office

5/11/2016

Date

I approve of the proposed removal actions as outlined in the Action Memorandum and attached Engineering Evaluation/Cost Analysis for all mining disturbances at the Riley Pass Site in Harding County, South Dakota.



Leanne Marten
Regional Forester

5/13/16

Date

